ORIGINAL ARTICLE

The Effect of Hydroimplantation Method and Viscoimplantation Method on Intraocular Pressure in the Early Postoperative Period

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ABSTRACT

Purpose: To compare early intraocular pressure changes and operation time in patients with and without viscoelastic material (VEM) used during intraocular lens (IOL) implantation.

Materials and Methods: 80 patients who underwent phacoemulsification surgery for cataract were included in the study. Patients were randomly divided into two groups according to whether VEM was used or not during intraocular lens implantation. In group 1 (n=40), the anterior chamber was irrigated with balanced saline solution (BSS) during IOL implantation and in group 2 (n=40), the anterior chamber and capsular bag were completely filled with VEM before IOL implantation and then IOL was implanted. Intraocular pressure (IOP) and corneal thickness were measured and recorded preoperatively and at the 3rd, 6th, 12th and 24th hours after surgery. In addition, the time elapsed during implantation was recorded.

Results: There were no statistically significant differences mean age, gender, preoperative IOP and preoperative central corneal thickness (CCT) between the two groups ($p>0.05$). In addition, no significant difference was found between CCT and IOP values performed at the 3nd, 6th, 12th and 24th hours postoperatively ($p>0.05$). The intraocular lens implantation time was significantly shorter in group 1 compared to group 2 ($p<0.001$). No case in either group experienced posterior capsular rupture or zonular dialysis.

Conclusion: When the traditional method of viscoimplantation was compared with hydroimplantation, no difference was found in early IOP. However, it was determined that the operation time was shortened with the use of hydroimplantation.

Keywords: Balanced salt solution, Hydroimplantation, Phacoemulsification, Viscoelastic material, Viscoimplantation.

INTRODUCTION

Cataract is one of the most common causes of blindness worldwide, but vision can be regained with phacoemulsification surgery. During surgery, viscoelastic material (VEM) is used in various stages such as providing anterior chamber stability, protecting endothelial cells, ease of manipulation and implantation of intraocular lens (IOL).[1,2] After IOL implantation, the viscoelastic material in front of and behind the lens is removed by irrigation/aspiration (I/A) however, it is sometimes not possible to completely clean the VEM remaining behind the lens and in the ciliary sulcus. VEM remaining in the anterior chamber may cause some postoperative complications such as capsular block syndrome, toxic anterior segment syndrome, and intraocular pressure (IOP) elevations.[3-5]

Hydroimplantation technique was first described by Tak.[6] In this technique, intraocular lens implantation is performed under continuous BSS irrigation without the use of VEM.

The aim of this study was to evaluate the safety of the hydroimplantation method and to compare early IOP between hydroimplantation method and viscoimplantation method.

MATERIALS AND METHODS

This prospective randomized study comprised 80 eyes of 80 patients who underwent phacoemulsification

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with the diagnosis of age related cataract. The research was confirmed by Institutional Review Board and was conducted in accordance with the Declaration of Helsinki. All patients gave written informed consent before their participation.

The patients were divided into 2 groups according to the types of BSS and VEM used during intraocular lens implantation. Group 1 was used BSS, and group 2 was used VEM. Patients in group 1 and group 2 were randomly selected for IOL implantation technique. All patients had similar rates of nuclear opacity (NO 3, NO 4 or NO 5) and cortical (C3, C4) cataracts according to the Lens Opacities Classification System III classification.

Exclusion criteria included cases with a small pupil, corneal disorder, glaucoma and uveitis history, traumatic cataracts, and pseudoexfoliation syndrome, history of vitrectomy surgery, axial length more than 25 mm and total surgical time of more than 30 minutes in the study. Additionally, patients with zonular defect who needed a capsular tension ring were excluded from the study.

Preoperative best corrected visual acuities, anterior and posterior segment examinations, IOP measurements and central corneal thickness of all patients were recorded. All surgeries were performed by a single surgeon (AG) under topical anesthesia using proparacain HCl (Alcaine®).

Surgical Technique

A clean corneal incision was made with a 2.8 mm microsurgical knife at 11 o'clock in the limbus. The anterior chamber was filled with VEM (3.0% sodium hyaluronate) and two side ports were made. Then a continuous curvilinear capsulorhexis was performed. Hydrodissection and hydrodelination were performed. After phacoemulsification, the cortex was cleaned by irrigation/aspiration (I/A). In group 1, the anterior chamber maintenance was provided by irrigation with an irrigation cannula from the left side port without VEM. The IOL placed in the cartridge was injected through the main port. IOL was placed in the capsular bag with the help of aspiration cannula. In group 2, the capsular bag and the anterior chamber were filled with VEM (1.4% Na hyaluronate) and the IOL was implanted into the capsular bag. Afterwards, the viscoelastic material above and below the IOL was cleaned. IOL implantation times were recorded. One-piece, foldable, acrylic hydrophilic with hydrophobic surface properties, aspheric IOL (Acriva UD 613) was used in both groups

Postoperative IOP and central corneal thickness were measured with non-contact devices Tonoref III (Nidek Co., Ltd, Gamagori, Japan) by air tonometry method at 3rd, 6th, 12th and 24th hours. Group 1 and group 2 values were compared. For patient safety, IOP-lowering treatments were allowed when IOP reached 30 mm Hg.

Statistical Analysis

Statistical analysis was done by SPSS statistical software (SPSS for windows 21.0, Inc., Chicago, USA). Group comparisons were made with independent sample t-tests. For comparison of continuous variables in each group over time one way repeated measure analysis of variance was used followed by a Bonferroni correction. P value less than 0.05 was defined statistically significant.

RESULTS

In this study, 80 patients who planned cataract surgery were included. This population consisted of 46 (57.5%) men and 34 (42.5%) women. Among 80 patients, 40 were in group 1 (hydroimplantation) and 40 in group 2 (viscoimplantation). The mean age of the patients in group 1 was 66.0±7.2 and group 2 was 68.40±9.2 years. There was no statistically significant difference between the two groups in terms of age and gender (respectively p=0.19, p=0.31).

The mean preoperative CCT was 584.8±42.1µm in group 1 and 533.9±33.1 µm in group 2 (p=0.09). There is no significant difference between CCT at postoperative 3rd, 6th, 12th and 24th hours (respectively; p=0.13, p=0.43, p=0.76, p=0.10). CCT peaked at 6 hours in both groups. There was no significant difference between IOP at preoperative and postoperative 3rd, 6th, 12th and 24th hours (respectively p=0.39, p=0.15, p=0.84, p=0.59, p=0.26) The highest values were observed in the postoperative 6th hour in both groups (Table 1). IOP increases of 30 mm Hg and above were observed in 5 people in group 1 and in 4 people in group 2 and needed dorzolamid per oral for IOP control.

The time taken for IOL injection and aspiration of viscoelastic material from the anterior chamber was significantly shorter in group 1 compared to group 2 (35.3±8.33 seconds, 95.33±7.16 seconds, respectively, p<0.001). Posterior capsule rupture was not observed in any of the cases.

DISCUSSION

Postoperative IOP increase in the early period following cataract surgery is one of the common side effects of phacoemulsification. Most of the time, the increase is temporary and does not cause permanent damage. However, if there is previous damage to the optic nerve due to glaucoma, these IOP increases can be dangerous. Increased IOP after surgery may increase the likelihood of cystoid macular edema.[7] In addition, we may encounter postoperative pain, nausea and deterioration in visual

Table 1: *Early intraocular pressure and central corneal thickness changes.*

	Group 1	Group 2	P
Preoperative IOP (mmHg)	12.7±3.3	13.4±3.7	0.39
Postoperative 3rd hour IOP (mmHg)	18.7±8.6	21.7±9.9	0.15
Postoperative 6th hour IOP (mmHg)	22.2±10.4	22.7±10.7	0.84
Postoperative 12th hour IOP (mmHg)	18.9±7.9	19.3±8.9	0.59
Postoperative 24th hour IOP (mmHg)	13.8±4.3	15.1±6.2	0.26
Preoperative CCT (µm)	584.8±42.1	533.9±33.1	0.09
Postoperative 3rd hour CCT (µm)	588.1±32.2	577.3±27.5	0.13
Postoperative 6th hour CCT (µm)	596.8±28.5	591.9±25.4	0.43
Postoperative 12th hour CCT (µm)	589.3±32.5	587.0±36.5	0.76
Postoperative 24th hour CCT (µm)	588.0±43.7	574.6±21.0	0.10
Mean-Time (sec)	35.3±8.33	95.33±7.16	**<0.001***

*: Statistically significant p values, CCT: Central Corneal Thickness, IOP: Intraocular Pressure

quality in patients due to elevated IOP.

In studies conducted, it was found that the increase in IOP most frequently occurred between the 3rd and 7th hours after the operation and it was observed that this elevation continued for 24 hours.[8] IOP follow-up in the first 24 hours varies in studies. On early IOP increase, the incidence of patients with a pressure of 30 mm Hg and above on the 1st day ranges from 2.1% to 8.9%.[9,10]

Many factors have been described that affect IOP in the early period after cataract surgery. One of the most common causes of IOP elevation in the early period after surgery is intraocular VEM by occluding the trabecular meshwork in the early period. The other risk factors are axial length over 25, preoperative high IOP, history of PEX syndrome or glaucoma, resident performed surgery and postoperative topical corticosteroid use.[11] And also use of tamsulosin has also been found to cause an increase in IOP.[12]

We don't want the increase in IOP too high to prevent pain, temporary blurring and dissatisfaction caused by IOP after a successful surgery. Small incision cataract surgery and various antiglaucomatous agents have been tried after surgery to prevent IOP increase.[13,14] Various studies have been conducted on the effect of the method, which minimizes the amount of viscoelastic substance remaining in the eye by implanting the IOL with BSS, on IOP.[6,15,16]

Viscoelastic materials can have different chemical compositions such as sodium hyaluronate, chondroitin sulfate, hydroxypropyl methylcellulose. And it may differ in its physical properties such as molecular weight, viscosity, plasticity. Complete removal of VEM during surgery is difficult and the use of higher-viscosity VEM is more likely to increase postoperative IOP.[15]

Lee et al[16] compared the group using BSS and using VEM during IOL implantation. Patients with glaucoma and pseudoexfoliation were excluded. It was determined that IOP peaked at the 6th hour in both groups. Also measurements were higher in the VEM group at the 6th and 24th hours. We did not detect any difference in IOP between the groups in our study. The study argues that the difference may be due to vitrectomized eyes. This elevation has been attributed to difficulties in removing the VEM behind the IOL due to miosis, overactive posterior capsule, and anterior chamber undulation in vitrectomized eyes.[16] And also this difference may be due to the different density of the viscoelastic material used when placing the lens. While a cohesive viscoelastic agent containing 1.6% high molecular weight sodium hyaluronate was used in this study, sodium hyaluronate with a molecular weight of 1.4% was used in our study.

Oğurel et al.[17] stated that they did not experience an increase in IOP with the hydroimplantation method in patients with pseudoexfoliation syndrome, and that the pressure increased to 30 mm Hg in 14% of the patients with the viscoelastic method. Pseudoexfoliation syndrome was not included in our study because of less weakness in the zonules and pupil dilation. However, Oğurel et al.[17] reported no complications with the hydroimplantation method in their study. They has been argued that this method can be used reliably in pseudoexfoliation patients, and that it is effective in preventing IOP increase and shortening the time of surgery.

Özcura et al.[18] stated that there was no difference in refractive or IOP between the two groups, that it shortened the surgical time and was a safe method.

Chen et al.[19] used a toric intraocular lens in their research. When comparing the use of hydroimplantation and viscoimplantation, they argued that it is an advantageous method in terms of surgical time and cost.

We think that hydroimplantation method, which is performed by experienced surgeons, is a safe method in cataract surgery. With the hydraimplantation method, it provides an additional advantage that there is no need for extra time and material for extra port entry. And we are of the opinion that it contributes to the completion of the surgery in a shorter time.

Conflict of interest

The authors do not have any financial or proprietary interest in a product, method, or material mentioned in the manuscript.

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