Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Comparison of Efficacy of the Anti-inflammatory Effect of Topical 0.1% Dexamethasone Sodium and Topical 0.05% Difluprednate Eye Drops after Small Incision Cataract Surgery

Prateek Koul[1], Abhishek Padha[2], Swati Sharma[3]

[1]Senior Resident, Department of Ophthalmology, VCGS Government Medical College, Srinagar, Uttarakhand, India, [2]Senior Resident, Department of Ophthalmology, Maharishi Markandeshwar Medical College, Solan, Himachal Pradesh, India, [3]Post Graduate Student, Department of Ophthalmology, Government Medical College, Jammu, Jammu and Kashmir, India

Abstract

Aims: The study aims to compare the efficacy of the anti-inflammatory effect of 0.1% dexamethasone sodium and 0.05% difluprednate eye drops after small incision cataract surgery (SICS).

Study Design: A prospective, randomized, and clinical study was conducted on patients.

Place and Duration of Study: This study was conducted in the Department of Ophthalmology, VCGS Government Medical College, Srinagar, Uttarakhand, between December 2017 and November 2018.

Materials and Methods: This study included two groups of 40 patients each (a total of 80 patients). 40 patients in Group A were randomly started on 0.1% dexamethasone eye drops postoperatively and another 40 patients in Group B were randomly started 0.05% difluprednate eye drops postoperatively. Response to the therapy was recorded on day 1, 7, and 40 on the parameters of post-operative anterior chamber reaction and post-operative visual acuity, and the results were compared.

Results: All results were correlated with final visual outcome, and post-operative flare, which showed 0.05% difluprednate, is clinically and statistically more effective in early post-operative period than 0.1% dexamethasone sodium to control inflammation in uneventful SICS.

Conclusions: After the comparison of the data in both the groups, the patients started on 0.05% difluprednate eye drops postoperatively showed better response to therapy ($P < 0.0001$) with respect to the parameters of best-corrected visual acuity and post-operative flare as compared to the patients started on 0.1% dexamethasone sodium eye drop therapy postoperatively, indicating that 0.05% difluprednate eye drops have a better anti-inflammatory effect.

Key words: Anti-inflammatory effect, Cataract surgery, Dexamethasone, Difluprednate

INTRODUCTION

Cataract surgery is, with >20–25 million procedures estimated annually, the most performed surgical intervention worldwide. Due to the invasive nature of modern cataract surgery, two outcomes are common: Infection and intraocular inflammation.[1] Infection, while an area of great concern and somewhat controversial in the ways to prevent it, is a long discussion delving into topics such as intracameral and post-operative care.[2]

Intraocular inflammation occurs due to the breakdown of cell membranes as a result of tissue injury. In effect, an inflammatory cascade occurs that involves the step-by-step enzymatic conversion of cell membrane phospholipids to bioactive prostaglandin molecules. First, surgical trauma activates phospholipase A2, which releases arachidonic acid from membrane phospholipids (fats from the lipid bilayer).

Access this article online

www.ijss-sn.com

Month of Submission : 11-2018
Month of Peer Review : 12-2018
Month of Acceptance : 12-2018
Month of Publishing : 01-2018

Corresponding Author: Dr. Prateek Koul, Room No 13, SR Hostel, HNB Base Hospital, Srikot, Pauri Srinagar, Uttarakhand - 246 174, India. Phone: +91-9720826318/+91-7006465381. E-mail: prateek.koul913@gmail.com

Arachidonic acid is then metabolized by cyclooxygenase (COX-1 and COX-2) into unstable endoperoxide intermediates (prostaglandin G2 and prostaglandin H2). This ultimately leads to the formation of prostaglandins. Prostaglandin H2 is then isomerized into different prostanoids.[3] All of these lead to local vasodilation and increased vascular permeability. This results in a number of symptoms including hyperemia, miosis, pain, photophobia, diminished visual acuity, and cystoids macular edema.[1] Inflammation is classically treated with steroids as well as with nonsteroidal anti-inflammatory drugs (NSAIDs).[4] NSAIDs drugs, in particular, reduce inflammation and pain by blocking prostaglandin synthesis by inhibiting COX activity.[5]

Treatment using topical NSAIDs after cataract surgery began in the 1970s[6] and studies have shown that they offer efficacy comparable to steroids in reducing post-operative inflammation but with a lower risk for adverse events in most patients.[1] NSAIDs drugs play a number of important roles in post-operative care including management of macular leakage.[7]

Visual prognosis of patient after cataract surgery depends on various pre-operative, intraoperative, and post-operative factors, of which postsurgical inflammation is the most important factor to the ophthalmologists. This postsurgical inflammation is due to various intraocular manipulations as irrigation of anterior chamber, injection of viscoelastic agent, handling of iris, intraocular lens implantation, etc.[8]

Ocular inflammation after cataract surgery presents ophthalmologists with treatment dilemma. While corticosteroids are traditionally the therapy of choice for inflammation, their long-term use for managing ocular inflammation can produce significant adverse effects.

The present study is an effort to compare the anti-inflammatory efficacy of post-operative 0.1% dexamethasone and 0.05% difluprednate eye drops in patients undergoing small incision cataract surgery (SICS).

MATERIALS AND METHODS

This prospective, randomized, and clinical study was conducted on patients attending the eye outpatient department of VCSG Government Medical College, Srinagar, Uttarakhand, India, during December 2017–November 2018.

A total of 80 patients who underwent SICS with posterior chamber intraocular lens (IOL) implantation were studied and patients were divided into two groups.

Group-A

It comprised 40 patients who received 0.1% dexamethasone eye drops 1 hourly 8 times a day for 7 days then tapered till 40 days.

Group-B

It comprised 40 patients who received 0.05% difluprednate eye drops 1 hourly 8 times a day for 7 days then tapered till 40 days.

Informed consent was obtained from all participant and associated adverse effects of the drug were explained.

Inclusion Criteria

Uncomplicated senile cataract, no previous ocular surgery, no previous ocular disease, not allergic to any drug, and uncomplicated SICS with in bag IOL implantation were included in the study.

Exclusion Criteria

Bleeding disorders, hypertension, diabetes mellitus, ischemic heart disease, bronchial asthma, connective tissue disorder, and poor compliance were excluded from the study. Preoperatively, all patients underwent visual acuity testing, measurement of intraocular pressure, and detailed slit lamp examination. All patients were operated by a single surgeon using similar instruments and techniques.

The post-operative medication was administered 8 times a day for 1 week and later tapered to 3 times a day for rest of the period. Both groups received topical mydriatic and cycloplegic agent as homatropine 2% once a day. Post-operative patients were followed up for 6 weeks at day 1, 7, and 40. Grading of post-operative inflammation was done on the following observations: Circumcorneal congestion, corneal edema, anterior chamber cells, and flare. Analgesia was subjectively estimated based on patients complaint of pain and discomfort.

RESULTS

Almost all patients in both groups had pain, lid edema, and ciliary congestion on the first 2 post-operative days.

Age

After comparing the data in both the groups [Table 1 and Figure 1], mean age of patients in Group A was 62.80 ± 11.47 while the age in Group B was 65.23 ± 11.23.

Sex Distribution and Laterality

In Table 2 and Figure 2, both groups had equal distribution of male and female genders. According to Table 3 and

Figure 3, majority patients in Group A had undergone surgery in the right eye, whereas in Group B, this was equal for both the eyes.

Day 1 Flare

According to Table 4 and Figure 4, majority of patients in Group A (52.50%) had moderate flare and same was the case for Group B (62.50%).

Day 7 Flare

According to [Table 5 and Figure 5] majority of patients in group A (70%) had moderate flare and same was the case in group B (77.50%)

Day 40 Flare

According to Table 6 and Figure 6, Group A had majority of patients with moderate flare, whereas Group B had majority of patients in the mild flare category ($P < 0.0001$).

Uncorrected Visual Acuity (UCVA) (Day 1)

According to Table 7 and Figure 7 in Group A, majority (62.50%) patients had visual acuity in the range 6/24–6/60 and the number was same in Group B.

Uncorrected Visual Acuity (Day 7)

According to [Table 8 and Figure 8] in Group A, majority(60%) patients had visual acuity in range 6/24-6/60 and in Group B Majority (70%) had visual acuity in range of 6/18-6/6

Best-corrected Visual Acuity (BCVA) (Day 40)

According to Table 9 and Figure 9, Group A had maximum patients (60%) in the range of 6/24–6/60, whereas in Group B, the maximum patients belonged to the range of 6/18–6/6 ($P < 0.0001$).

Change between UCVA (Day 1) and BCVA (Day 40)

Mean change in visual acuity in Group A [Table 10 and Figure 10] was 86.33%, whereas the same change

Table 1: Group comparison for age distribution (years)

Age (years)	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
≤50	7 (17.50)	4 (10.00)
51–60	9 (22.50)	7 (17.50)
61–70	15 (37.50)	20 (50.00)
>70	9 (22.50)	9 (22.50)
Mean age±SD	62.80±11.47	65.23±11.23
P-value	0.223	

SD: Standard deviation

Table 2: Sex distribution

Sex	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
Male	20 (50.0)	20 (50.0)
Female	20 (50.0)	20 (50.0)
P-value	–	

Table 3: Laterality

Eye	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
Right eye	25 (62.50)	20 (50.0)
Left eye	15 (37.50)	20 (50.0)
P-value	0.071	

Table 4: Day 1 flare

Day 1 flare	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
Mild flare	10 (25.00)	6 (15.00)
Moderate flare	21 (52.50)	25 (62.50)
Severe flare	9 (22.50)	9 (22.50)
P-value	0.192	

Table 5: Day 7 flare

Day 7 flare	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
Mild flare	12 (30.00)	8 (20.00)
Moderate flare	28 (70.00)	31 (77.50)
Severe flare	0 (0.00)	1 (2.50)
P-value	0.092	

Table 6: Day 40 flare

Day 40 flare	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
Mild flare	17 (42.50)	32 (20.00)
Moderate flare	23 (57.50)	8 (80.00)
Severe flare	0 (0.00)	0 (0.00)
P-value	<0.0001	

Table 7: UCVA (day 1)

UCVA	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
≤6/18–6/6	4 (15.00)	17 (42.50)
6/24–6/60	25 (62.50)	23 (57.50)
5/60≥	11 (27.50)	0 (0.00)
P-value	<0.0001	

UCVA: Uncorrected visual acuity

Table 8: UCVA (day 7)

UCVA	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
≤6/18–6/6	11 (27.50)	28 (70.00)
6/24–6/60	24 (60.00)	12 (30.00)
5/60≥	5 (12.50)	0 (0.00)
P-value	<0.0001	

UCVA: Uncorrected visual acuity

was recorded as 59.03% in Group B. This change was statistically significant ($P < 0.0001$).

Change Between Ucva Day 7 and (BCVA) (Day 40)

Mean change in visual acuity in Group A [Table 11 and Figure 11] was 43.75%,Whereas the same change was recorded as 28.41% in Group B. P<0.0001

DISCUSSION

Topical steroids are the most common methods of administering steroids to the eye and following a single topical drop, steroid is measurable in human aqueous humor within 15–30 min.[9] They are the main drugs that have been used so far for controlling post-operative inflammation after intraocular surgery. Steroids act by inhibiting production of factors (prostaglandins, leukotrienes, etc.), which are critical in generating the inflammatory response by multiple type of cells. When applied topically, the drug has to penetrate the cornea across the three barriers: Corneal epithelium-lipophilic in nature, corneal stroma-hydrophilic, and endothelium lipophilic. Leopold *et al.*[10] showed that lipophilic layers of cornea provide resistance to polar molecules, whereas stroma being hydrophilic has resistance for lipid-soluble molecules; hence, substance used should be of biphasic polarity. Studies of Leibowitz *et al.*[11] with radiolabelled dexamethasone and prednisolone have shown that acetate in the form of suspension can penetrate through a normal and uninflammed cornea with an intact epithelium most easily and can attain the maximum concentration of 2336 μg/min/g within 30 min of topical application in anterior chamber.[12]

Schoenwald and Boltralik[13] also showed in experimental animals that prednisolone acetate suspension reaches the higher corticosteroid levels in anterior chamber among the other drugs used.

Table 9: BCVA (day 40)

BCVA (day 40)	Number of patients	
	Group A (*n*=40)	Group B (*n*=40)
≤6/18–6/6	16 (40.00)	33 (82.50)
6/24–6/60	24 (60.00)	7 (17.50)
5/60≥	0 (0.00)	0 (0.00)
P-value	<0.0001	

BCVA: Best-corrected visual acuity

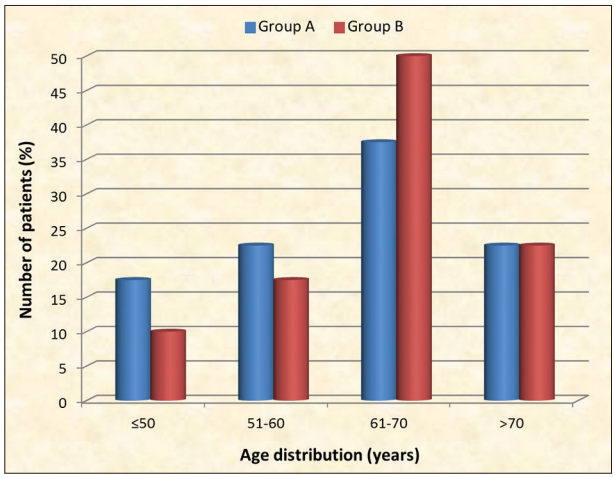

Figure 1: Age distribution (years)

Table 10: Change between UCVA (day 1) and BCVA (day 40)

Visual acuity	Number of patients					
	Group A (*n*=40)			Group B (*n*=40)		
	UCVA (day 1)	BCVA (day 40)	Change (%)	UCVA (day 1)	BCVA (day 40)	Change (%)
≤6/18–6/6	4 (15.00)	16 (40.00)	75.00	17 (42.50)	33 (50.0)	48.48
6/24–6/60	25 (62.50)	24 (60.00)	84.00	23 (57.50)	7 (50.0)	69.57
5/60≥	11 (27.50)	0 (0.00)	100.00	0 (0.00)	0 (50.0)	0.00
Mean change	86.33			59.03		
P-value	<0.0001					

UCVA: Uncorrected visual acuity, BCVA: Best-corrected visual acuity

Table 11: Change between UCVA (day 7) and BCVA (day 40)

Visual acuity	Number of patients					
	Group A (*n*=40)			Group B (*n*=40)		
	UCVA (day 7)	BCVA (day 40)	Change (%)	UCVA (day 7)	BCVA (day 40)	Change (%)
≤6/18–6/6	11 (27.50)	16 (40.00)	31.25	28 (70.00)	33 (82.50)	15.15
6/24–6/60	24 (60.00)	24 (60.00)	0.00	12 (30.00)	7 (17.50)	41.67
5/60≥	5 (12.50)	0 (0.00)	100.00	0 (0.00)	0 (0.00)	0.00
Mean change	43.75			28.41		
P-value	<0.0001					

UCVA: Uncorrected visual acuity, BCVA: Best-corrected visual acuity

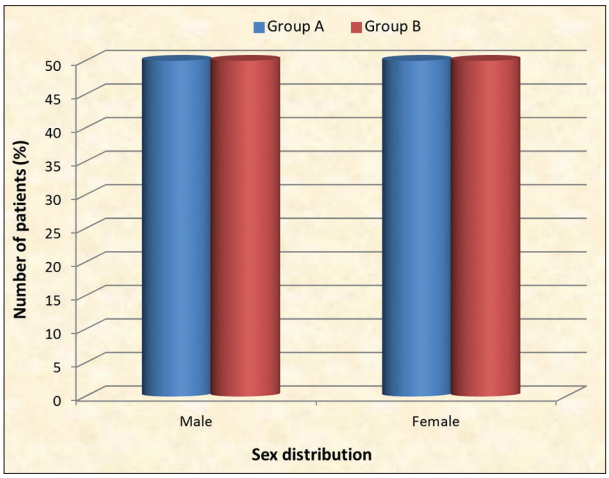

Figure 2: Sex distribution

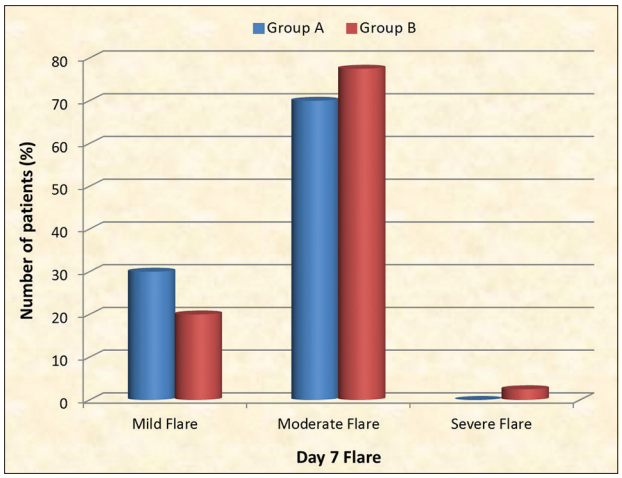

Figure 5: Day 7 flare

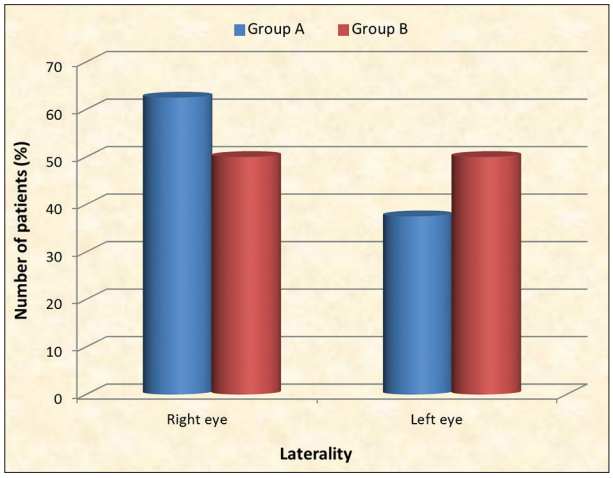

Figure 3: Laterality

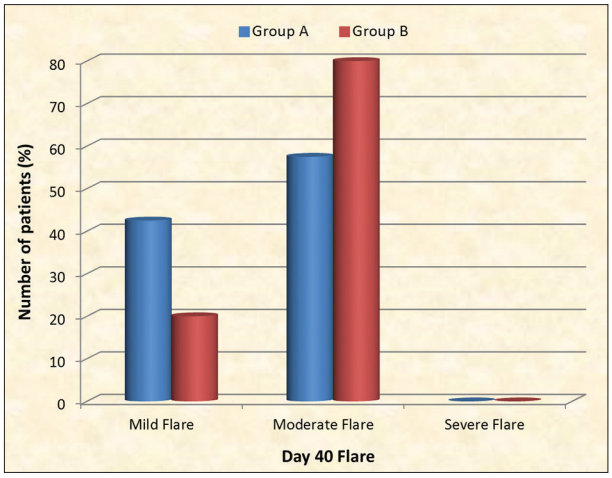

Figure 6: Day 40 flare

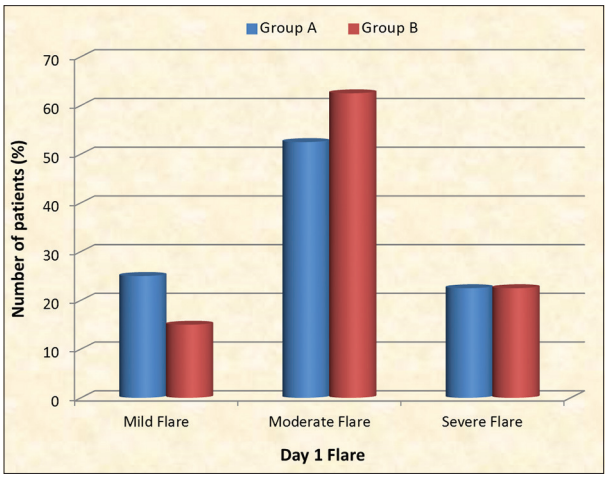

Figure 4: Day 1 flare

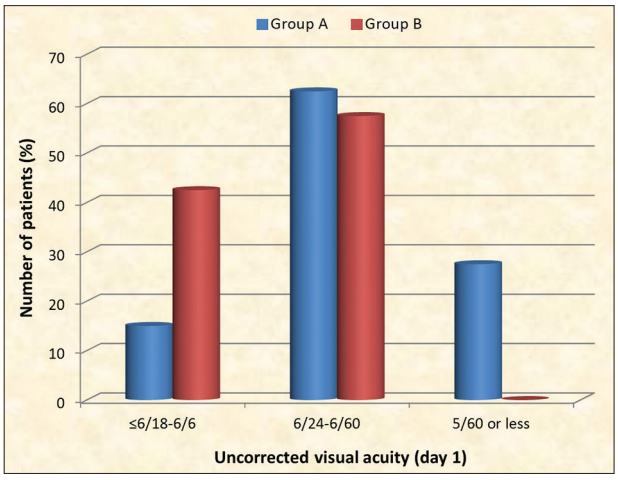

Figure 7: Uncorrected visual acuity (day 1)

The bioavailability and effectiveness of the anti-inflammatory drugs were studied by Leibowitz *et al.* [12] using radiolabeled polymorph nuclear leucocytes systemically before they invade the cornea. Commercially available preparation used for the present study of 0.05% difluprednate in the form of suspension and dexamethasone was 0.5% dexamethasone sodium solution.

Difluprednate acts by inhibiting the action of phospholipase A2 and thereby preventing the release of arachidonic

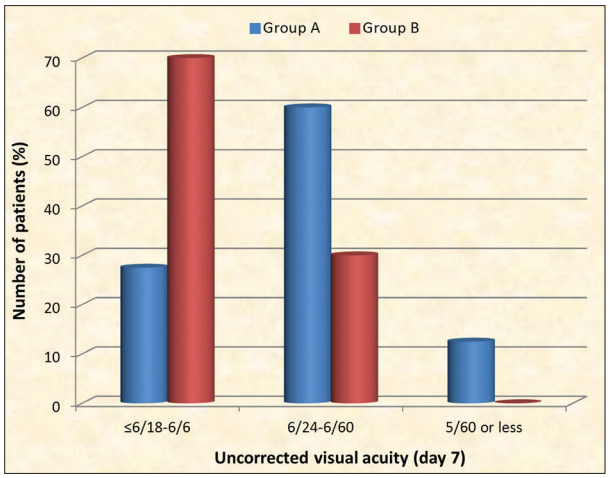

Figure 8: Uncorrected visual acuity (day 7)

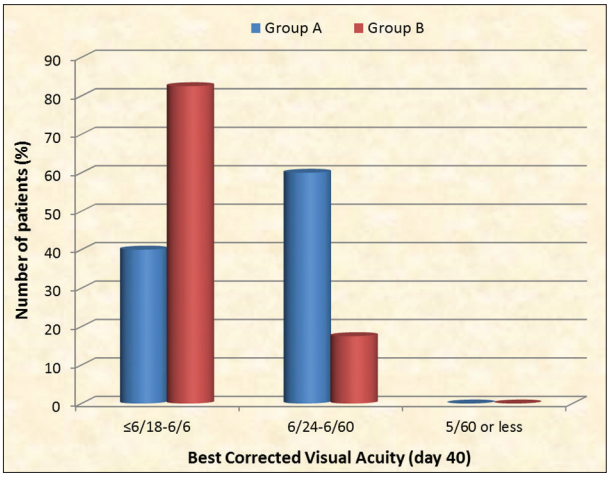

Figure 9: Best-corrected visual acuity (day 40)

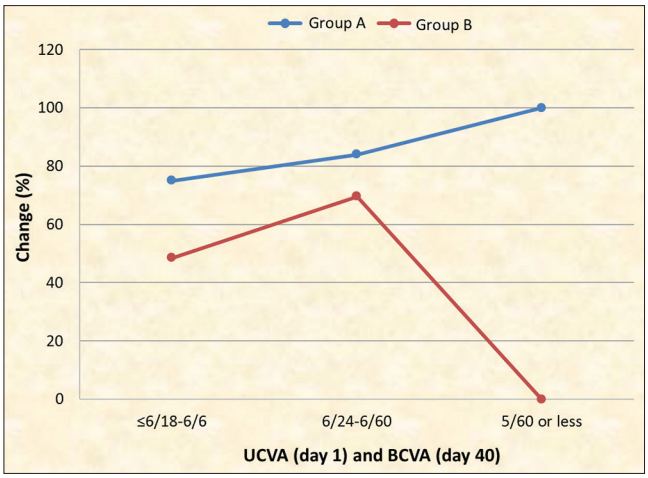

Figure 10: Uncorrected visual acuity (day 1) and best-corrected visual acuity (day 40)

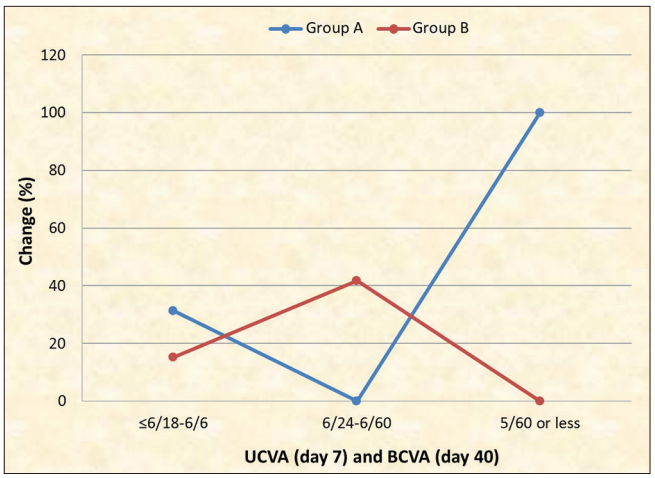

Figure 11: Uncorrected visual acuity (day 7) and best-corrected visual acuity (day 40)

acid, which, in turn, is responsible for formation of prostaglandin and leukotrienes. Prednisolone acetate is 4 times potent than cortisol and also has mineralocorticoid activity. The half-life is 12 h and is less toxic as compared to dexamethasone sodium.

The experimental data put forth by Leibowitz and Kupferman,[10] with studies *in vivo* showed that prednisolone acetate being biphasic in nature attains a maximum conc. of 2336 μg in anterior chamber with epithelium intact which shows that its acetate form is more potent than its phosphate form which shows a conc. of 968 μg. Similar results were obtained by O lejnika and Weisbecker.[14]

Furthermore, according to the present study, 0.05% difluprednate had better effects in controlling post-operative inflammation than 0.1% dexamethasone with regard to the parameters in consideration, i.e., post-operative visual acuity and post-operative flare.

CONCLUSIONSW

The present study concludes that the post-operative anti-inflammatory potency of 0.05% difluprednate is statistically better than 0.1% dexamethasone sodium eye drops. This study recommends the use of topical 0.05% difluprednate to control inflammation after uneventful cataract surgery in Indian eyes. The effect of 0.05% difluprednate was not studied on cataract surgery with pre-operative complications; hence, its effect in treating such eyes is not known.

REFERENCES

1. Simone JN, Whitacre MM. Effects of anti-inflammatory drugs following cataract extraction. Curr Opin Ophthalmol 2001;12:63-7.
2. Braga-Mele R, Chang DF, Henderson BA, Mamalis N, Talley-Rostov A, Vasavada A, et al. Intracameral antibiotics: Safety, efficacy, and preparation. J Cataract Refract Surg 2014;40:2134-42.
3. Chen L, Yang G, Grosser T. Prostanoids and inflammatory pain. Prostaglandins Other Lipid Mediat 2013;104-105:58-66.
4. Jones BM, Neville MW. Nepafenac: An ophthalmic nonsteroidal antiinflammatory drug for pain after cataract surgery. Ann Pharmacother 2013;47:892-6.

5. Ahuja M, Dhake AS, Sharma SK, Majumdar DK. Topical ocular delivery of NSAIDs. AAPS J 2008;10:229-41.
6. Donnenfeld ED. Current use of non-steroidal anti inflammatory drugs in the treatment of ocular inflammation related to cataract surgery. Eur Ophthalmic Rev 2012;6:173-7.
7. Miyake K, Ota I, Miyake G, Numaga J. Nepafenac 0.1% versus fluorometholone 0.1% for preventing cystoid macular edema after cataract surgery. J Cataract Refract Surg 2011;37:1581-8.
8. Hall MJ. Stallard's Eye Surgery. 7th ed. New Delhi: Butterworth International Edition, Replica Press Pvt Ltd.; 1989. p. 286-329.
9. Watson D, Noble MJ, Dutton GN, Midgley JM, Healey TM. Penetration of topically applied dexamethasone alcohol into human aqueous humor. Arch Ophthalmol 1988;106:686-7.
10. Leopold IH, Kroman HS, Green H. Intraocular penetration of prednisone and prednisolone. Trans Am Acad Ophthalmol Otolaryngol 1955;59:771-8.
11. Leibowitz HM, Lass JH, Kupferman A. Quantitation of inflammation in the cornea. Arch Ophthalmol 1974;92:427-30.
12. Leibowitz HM, Kupferman A. Anti-inflammatory effectiveness in the cornea of topically administered prednisolone. Invest Ophthalmol 1974;13:757-63.
13. Schoenwald RD, Boltralik JJ. A bioavailability comparison in rabbits of two steroids formulated as high-viscosity gels and reference aqueous preparations. Invest Ophthalmol Vis Sci 1979;18:61-6.
14. Olejnik O, Weisbecker CA. Ocular bioavailability of topical prednisolone preparations. Clin Ther 1990;12:2-11.

How to cite this article: Koul P, Padha A, Sharma S. Comparison of Efficacy of the Anti-Inflammatory Effect of Topical 0.1% Dexamethasone Sodium and Topical 0.05% Difluprednate Eye Drops after Small Incision Cataract Surgery. Int J Sci Stud 2019;6(10):35-41.

Source of Support: Nil, **Conflict of Interest:** None declared.