



Comparative Evaluation of the Anti-Inflammatory Effect of Topical 1 % Prednisolone Acetate, 0.1 % Dexamethasone Sodium & 0.1 % Betamethasone Sodium Eye Drops After SICS

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ABSTRACT

Cataract is the leading cause of blindness worldwide and cataract extraction is the treatment of choice leading to the improvement in the quality of life¹, cognitive function² and productivity as reported by multiple published studies.

Purpose:

- To study the efficacy and safety of topical Prednisolone acetate 1% , Dexamethasone sodium phosphate 0.1% & Betamethasone sodium phosphate 0.1%.
- Measurement of I.O.P in study population.

Materials and Methods: 90 consecutive patients who underwent uneventful SICS with PCIOL implantation were randomly assigned to either of study groups. The three study drugs anti – inflammatory efficacy was compared by closely examining the operated eyes for inflammatory response and visual acuity on post – op day 1, day 3, day 10th, day 17th & day 30th. **Results:** The final visual outcome was correlated with all the results which showed that topical 1% Prednisolone acetate is clinically more effective than topical 0.1% Dexamethasone sodium and 0.1% Betamethasone sodium to control the post-op inflammation in uneventful SICS.

Conclusion: Topical 1% Prednisolone acetate is more effective than topical 0.1% Dexamethasone sodium & 0.1% Betamethasone sodium in controlling postoperative inflammation after uneventful SICS.

KEYWORDS

1% Prednisolone, 0.1% Dexamethasone, 0.1% Betamethasone, SICS, Inflammation

Introduction:

Cataracts are a major cause of blindness and severe visual impairment, leading to bilateral blindness in an estimated 20 million people worldwide in 2004³. Over half of all persons over the age of 65 develop age-related cataracts with visual disability⁴. Globally, the number of cataract cases is expected to increase as populations age and lifespans increase⁵.

There is no medical treatment for cataracts^{4, 5}. Surgical removal of cataract remains the only treatment option for patients with failing vision⁵. Small-incision cataract surgery using phacoemulsification has largely replaced extracapsular cataract extraction because of faster healing, smaller wounds and fewer resultant complications, with improved patient outcomes.

Despite surgical advances, post-cataract surgery inflammation is still a common cause of patient discomfort, delayed recovery and reduced visual outcome. Ocular inflammation after cataract surgery is generally managed by topical anti-inflammatory drugs such as corticosteroids or non-steroidal anti-inflammatory drugs (NSAIDs).

Materials & methods:

A comparative, prospective study was conducted at Ophthalmology OPD of SVS Medical College and Hospitals, Mahabubnagar, Telangana over a period of 1 yr from January 2014 to January 2015. Ninety patients with senile cataract who underwent uneventful SICS with in bag PCIOL implantation were included in the study after obtaining informed consent. The inclusion criteria were as follows: uncomplicated senile cataract, no previous ocular surgery, no previous ocular disease,

not allergic to any drugs, uncomplicated SICS with PCIOL in the bag implantation. The exclusion criteria were as follows: bleeding disorders or on anticoagulant therapy, systemic disease such as hypertension, diabetes mellitus, ischemic heart disease, bronchial asthma, connective tissue disorders, immunological disorders and poor compliance. Preoperatively; all patients underwent visual acuity testing, measurement of intraocular pressure (IOP) and detailed slit lamp examination. Preoperative preparation of eye was identical in all patients. Anaesthesia was a peribulbar block of 2 % lignocaine with epinephrine and hyaluronidase. All patients were operated by a single surgeon using similar instruments and techniques.

Patients were randomly assigned to the three study groups, Group A, who received 1% Prednisolone acetate, Group B received 0.1% Dexamethasone sodium and Group C received topical 0.1% Betamethasone sodium (30 patients in each group) post - operatively. Post operative treatment comprised of 8 times a day for 1 week of corticosteroids. Later patients were instructed to decrease the frequency of corticosteroids to 6 times a day for 1 week then gradually taper weekly 4/3/2/1 times respectively and discontinued after 6 weeks post operatively. All patients received additional drops of Moxifloxacin 4 times daily and Cyclopentolate 2 times from 1st post op day until day 15. Follow up visits were scheduled for Day 1st, Day 3rd, Day 10th, Day 17th and Day 30th. Grading of postoperative inflammation was done based on the following observations: circumcorneal congestion, corneal oedema, anterior chamber cells and flare. Analgesia was subjectively estimated based on patient's complain of pain or discomfort.

Results:

A total of 90 patients studied were divided into three groups of 30 patients each. Group A treated with Prednisolone acetate 1 %, Group B with Dexamethasone sodium phosphate 0.1 % & Group C with Betamethasone sodium phosphate 0.1 % post - operatively. Groups were comparable in age, sex and type of cataract. Majority of patients in this study were in the

age group of 50 to 60 years accounting for 72 % and 60 to 70 years accounting for 28 %. Total males (63 %) were more than females (37%).Male: female ratio is 2:1.

ANALYSIS OF POST OPERATIVE INFLAMMATION:

Resolution of post – operative inflammation from grade 1, 2, 3 to grade 0 was as follows:

Conjunctival erythema & Ciliary flush (Table 1)

Grade - 1 scores of inflammation resolution to Grade - 0						
DAY	Group A (Prednisolone Acetate 1%)		Group B (Dexamethasone sod. Phosphate 0.1%)		Group C (Betamethasone sod.phosphate 0.1%)	
	Total no. of patients	% of Resolution	Total no. of patients	% of Resolution	Total no. of patients	% of Resolution
1 st day	4	-	6	-	6	-
3 rd day	2	50%	+	NIL	+	NIL
10 th day	2	50%	6	100%	6	100%
17 th day	-	-	-	-	-	-
30 th day	-	-	-	-	-	-
Grade – 2 scores of inflammation resolution to Grade - 0						
1 st day	20	-	22	-	18	-
3 rd day	20	NIL	22	NIL	18	NIL
10 th day	15	75%	15	68.18%	11	61.11%
17 th day	5	25%	7	31.81%	7	38.88%
30 th day	-	-	-	-	-	-
Grade - 3 scores of inflammation resolution to Grade - 0						
1 st day	6	-	2	-	6	-
3 rd day	+	NIL	+	NIL	+	NIL
10 th day	4	66.66%	1	50%	2	33.33%
17 th day	2	33.33%	1	50%	4	66.66%
30 th day	-	-	-	-	-	-

Anterior Chamber Cell Count (Table 2)

Grade - 1 scores of inflammation resolution to Grade - 0						
DAY	Group A (Prednisolone Acetate 1%)		Group B (Dexamethasone sod. Phosphate 0.1%)		Group C (Betamethasone sod.phosphate 0.1%)	
	Total no. of patients	% of resolution	Total no. of patients	% of resolution	Total no. of patients	% of resolution
1 st day	4	-	5	-	5	-
3 rd day	3	75%	3	60%	3	60%
10 th day	1	25%	2	40%	2	40%
17 th day	-	-	-	-	-	-
30 th day	-	-	-	-	-	-
Grade – 2 scores of inflammation resolution to Grade - 0						
1 st day	22	-	23	-	20	-
3 rd day	5	22.72%	3	13.04%	2	10%
10 th day	15	68.18%	16	69.56%	10	50%

17 th day	2	9.09%	4	17.39%	8	40%
30 th day	-	-	-	-	-	-
Grade - 3 scores of inflammation resolution to Grade - 0						
1 st day	4	-	2	-	5	-
3 rd day	+	NIL	+	NIL	+	NIL
10 th day	3	75%	1	50%	2	40%
17 th day	1	25%	1	50%	3	60%
30 th day	-	-	-	-	-	-

Anterior chamber flare count (Table 3)

Grade - 1 scores of inflammation resolution to Grade - 0						
DAY	Group 1 (Prednisolone Acetate 1%)		Group 2 (Dexamethasone sod. Phosphate 0.1%)		Group 3 (Betamethasone sod.phosphate 0.1%)	
	Total no. of patients	% of resolution	Total no. of patients	% of resolution	Total no. of patients	% of resolution
1 st day	3	-	4	-	3	-
3 rd day	3	100%	4	100%	3	100%
10 th day	-	-	-	-	-	-
17 th day	-	-	-	-	-	-
30 th day	-	-	-	-	-	-
Grade – 2 scores of inflammation resolution to Grade - 0						
1 st day	24	-	20	-	21	-
3 rd day	11	45.83%	4	20%	4	19.04%
10 th day	11	45.83%	14	70%	15	71.42%
17 th day	2	8.3%	2	10%	2	9.52%
30 th day	-	-	-	-	-	-
Grade -3 scores of inflammation resolution to Grade - 0						
1 st day	3	-	6	-	6	-
3 rd day	+	NIL	+	NIL	+	NIL
10 th day	2	66.66%	3	50%	2	33.33%
17 th day	1	33.33%	3	50%	4	66.66%
30 th day	-	-	-	-	-	-

All these observations and results show that topical 1% Prednisolone acetate is clinically and statistically more effective in

early postoperative period than 0.1% Dexamethasone sodium & Betamethasone sodium to control the inflammation in uneventful cataract surgeries.

Intra ocular pressure at the end of 6 weeks:

I.O.P (mm of hg)	Prednisolone acetate (1%)		Dexamethasone .sod (0.1)%		Betamethasone .sod (0.1%)	
	Number	Percent	Number	Percent	Number	Percent
14mmHg	12	40%	5	16.66%	4	13.33%
16mmHg	15	50%	12	40%	10	33.33%
18mmHg	3	10%	8	26.66%	10	33.33%
20mmHg	-	-	5	16.66%	6	20%
22mmHg	-	-	-	-	-	-

In the present study for baseline I.O.P, raise in I.O.P is little bit more with Dexamethasone .sod (0.1%) and Betamethasone .sod (0.1%) when compared with Prednisolone acetate (1%).

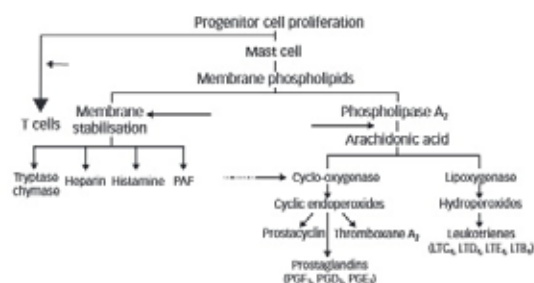
There is no clinically significant raise in I.O.P > 10 mmHg in all the three groups post operatively as period of instillation of steroid drops is short (45 days).

Discussion:

Acquired cataract is the leading cause of blindness worldwide⁶. Surgical intervention is the treatment of choice for those diagnosed visually significant cataract. Although there are no standardized post-operative regimens for uncomplicated cataract surgery, the common or prevailing therapeutic regimen is a three-drug combination: an antimicrobial, a topical steroid and topical NSAID. Despite surgical advances, post-cataract surgery inflammation is still a common cause of patient discomfort, delayed recovery and reduced visual outcome^{7, 8}. Post-cataract surgery inflammation presents as protein flare and inflammatory cells in the anterior chamber, hyperaemia, miosis, oedema, leukocyte migration, fibroblast proliferation and scar formation, along with other local responses to the released pro-inflammatory cytokines^{9, 10}.

Ocular inflammation after cataract surgery is generally managed by topical anti-inflammatory drugs such as corticosteroids and/or non-steroidal anti-inflammatory drugs (NSAIDs). Compared with NSAIDs, corticosteroids have a wider range of activity in relieving inflammation (Figure.1). Corticosteroids act to reduce inflammation at multiple points in the inflammatory cascade (Figure.1), including both the cyclo-oxygenase pathway and the lipoxygenase pathway through inhibition of phospholipase A₂, producing a reduction in both prostaglandins and leukotrienes¹¹.

Figure 1: Schema of the Inflammatory Cascade, with Sites at which Steroids and Non-steroidal Anti-inflammatory Drugs Act to Reduce Inflammation



NSAIDs = non-steroidal anti-inflammatory drugs; PAF = platelet-activating factor.

In this study the percentage of male was nearly 63% as compared to female 37% in this study, the variation could be because of small group of patients taken up for study. Approximately male to female ratio is 2: 1

Although the no. of patients in this study was small to give sound statistical evidence it was observed that all the patients taken up for study following uncomplicated cataract surgery postoperatively with

Grade – 1 scores of inflammation showed resolution to **Grade – 0** as follows:

In **Group A** treated with **Prednisolone Acetate 1%** eye drops

- Conjunctival erythema & Ciliary flush in 50% of patients by day 3 & rest 50 % by day 10.
- Anterior chamber cells in 75% of patients by day 3 & 25% by day 10.
- Anterior chamber flare in 100% of patients by day 3.

In **Group B** treated with **Dexamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema & Ciliary flush in 100 % of patients by day 10.
- Anterior chamber cells in 60% of patients by day 3 & 40% of patients by day 10.
- Anterior chamber flare in 100 % of patients by day 3.

In **Group C** treated with **Betamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema and Ciliary flush in 100 % of patients by day 10.

tients by day 10.

- Anterior chamber cells in 60% of patients by day 3 & 40 % of patients by day 10.
- Anterior chamber flare in 100 % patients by day 3.

Grade – 2 scores of post operative inflammation showed resolution to **Grade– 0** as follows: In **Group A** treated with **Prednisolone Acetate 1%** eye drops

- Conjunctival erythema & Ciliary flush in 75% of patients by day 10 & 25 % by day 17.
- Anterior chamber cells in 22% of patients by day 3, 68.18% by day 10 & 9.09 % by day 17.
- Anterior chamber flare in 45.83% of patients by day 3, 45.83% by day 10 & 8.3% by day 17.

In **Group B** treated with **Dexamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema & Ciliary flush in 68.18% of patients by day 10 & 31.81% by day 17.
- Anterior chamber cells in 13.04% of patients by day 3, 69.56% by day 10 & 17.39% by day 17.
- Anterior chamber flare in 20 % of patients by day 3, 70% by day 10 & 10 % by day 17.

In **Group C** treated with **Betamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema & Ciliary flush in 61.11 % of patients by day 10 & 38.88 % in day 17.
- Anterior chamber cells in 10% of patients by day 3, 50 % by day 10 & 40 % by day 17.
- Anterior chamber flare in 19.04% of patients by day 3, 71.42% by day 10 & 9.52% by day 17.

Grade – 3 scores of inflammation showed resolution to **Grade – 0** as follows:

In **Group A** treated with **Prednisolone Acetate 1%** eye drops

- Conjunctival erythema & Ciliary flush in 66.66% of patients by day 10 & 33.33% by day 17.
- Anterior chamber cells in 75% of patients by day 10 & 25% by day 17.
- Anterior chamber flare in 66.66% of patients by day 10 & 33.33% by day 17.

In **Group B** treated with **Dexamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema & Ciliary flush in 50 % of patients by day 10 & 50% by day 17.
- Anterior chamber cells in 50 % of patients by day 10 & 50% by day 17.
- Anterior chamber flare in 50% of patients by day 10 & 50 % by day 17.

In **Group C** treated with **Betamethasone Sodium Phosphate 0.1%** eye drops

- Conjunctival erythema & Ciliary flush in 33.33% by day 10 and 66.66% by day 17.
- Anterior chamber cells in 40% of patients by day 10 & 60% by day 17.

There was 100 % reduction in signs and symptoms of inflammation by the end of 2 – 3 weeks postoperatively in all the groups. Restoration of visual acuity was similar in all groups. Subjective and Objective tolerance was good in all 3 groups. There was no case of clinical cystoid macular edema. No adverse effects were noted. Four patients had Posterior capsular opacity. There was no rebound of signs and symptoms of inflammation after cessation of therapy.

Prolonged use of topical steroids can produce elevated I.O.P in general population and especially in corticosteroid responders. In this study there was no significant elevation of I.O.P was seen (>10 mmHg) most likely because of short duration of usage (45days) and decrease in dose regimen from 1 drop 8 times daily till day 7, gradually tapered weekly discontinuing after 6 weeks.

CONCLUSION

All the three topical steroids preparations used in the treatment of post operative inflammation are useful. As per the

observation and analysis the Prednisolone acetate 1% is more efficacious followed by Dexamethasone sodium 0.1% and Betamethasone sodium 0.1% eye drops in descending order of efficacy. The more potency of prednisolone acetate 1% suspension is because of its chemical structure being marketed as acetate derivative which is biphasic insolubility with greater bio availability in cornea and anterior chamber as compared to phosphate derivatives. Similar study was done at Saraswathi Institute of Medical Sciences (SIMS) Hapur (western uttarpradesh)¹² stating Prednisolone acetate is clinically and statistically more effective than Dexamethasone sodium in early post operative period to control the inflammation in uneventful small incision cataract surgery with posterior chamber intraocular lens implantation.

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