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EFFICACY OF TOPICAL 0.1% DEXAMETHASONE FOR THREE WEEKS AFTER UNCOMPLICATED LOW-RISK CATARACT EXTRACTION IN TERMS OF AQUEOUS FLARE AND CELLULAR TYNDALL ASSESSMENT

Original Research (ID: 1679)

Dr. Muhammad Qasim Yazar[1]*, Dr Bahadur Iftikhar[2], Dr Saima Khalid[3], Dr. Wazir Muhammad Hasan[4]
[1]PGR FCPS Ophthalmology, Mayo Hospital Lahore
[2]Senior Registrar Ophthalmology, Allied Hospital-II, Faisalabad
[3]FCPS Resident Ophthalmology, Mayo Hospital Lahore
[4]Consultant Ophthalmology, RHQ Hospital Skardu
Corresponding Author: Dr. Muhammad Qasim Yazar, PGR FCPS Ophthalmology, Mayo Hospital Lahore, mqyazar@hotmail.com
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ABSTRACT

Background: Cataract extraction is routinely followed by a variable degree of anterior chamber inflammation, even after uncomplicated surgery. Topical corticosteroids remain a common postoperative choice because they reduce inflammatory activity and support visual recovery. Aqueous flare and cellular Tyndall assessment provide clinically useful indicators of blood-aqueous barrier disturbance and intraocular inflammation. This study evaluated whether a three-week course of topical 0.1% dexamethasone effectively controlled postoperative inflammation in low-risk cataract patients.

Objective: To determine the efficacy of topical 0.1% dexamethasone administered for three weeks after uncomplicated low-risk cataract extraction in terms of aqueous flare and cellular Tyndall assessment.

Methods: This descriptive case series was conducted in the Department of Ophthalmology, Mayo Hospital, Lahore, from 11 May 2023 to 11 October 2023. A total of 80 patients aged 40–70 years with senile cataract planned for uncomplicated cataract extraction with intraocular lens implantation were enrolled through non-probability consecutive sampling. Patients with uncontrolled diabetes, uncontrolled hypertension, ischemic heart disease, bronchial asthma, allergy, immunological disease, systemic steroid use, anticoagulant therapy, complicated cataract, mature cataract, lens-induced glaucoma, poor compliance, or intraoperative complications were excluded. Preoperative assessment included Snellen visual acuity, non-contact air-puff tonometry, and slit-lamp examination. All surgeries were performed by a single surgeon using standardized techniques. Postoperatively, topical 0.1% dexamethasone was prescribed for three weeks. Anterior chamber cells and flare were assessed using Hogan's slit-lamp grading system. Data were analyzed using SPSS version 25.

Results: The mean age was 57.63 ± 6.55 years. Of 80 patients, 45 were male and 35 were female. Right-eye surgery was performed in 36 patients, while 44 underwent left-eye surgery. The mean anterior chamber cell value was 0.05 ± 0.150. Overall efficacy was observed in 72 patients, while 8 patients did not achieve efficacy. Efficacy was 88.9% in patients aged 40–55 years and 90.9% in patients aged 56–70 years. Male and female efficacy rates were 93.3% and 85.7%, respectively. Right-eye and left-eye efficacy rates were 88.9% and 90.9%, respectively. Efficacy was 77.8% in nuclear sclerosis grade 2 and 96.2% in nuclear sclerosis grade 3, with a statistically significant association.

Conclusion: Topical 0.1% dexamethasone administered for three weeks after uncomplicated low-risk cataract extraction was effective in controlling postoperative anterior chamber inflammation. The findings support its practical use as a postoperative anti-inflammatory regimen in selected low-risk cataract patients.

Keywords: Anterior Chamber; Aqueous Humor; Cataract; Cataract Extraction; Dexamethasone; Inflammation; Postoperative Care.

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INTRODUCTION

Cataract extraction is one of the most commonly performed ophthalmic surgical procedures worldwide, and continuous refinement in surgical techniques has made modern cataract surgery increasingly safe, minimally invasive, and associated with faster visual recovery. These advances have reduced surgical trauma to intraocular tissues and have consequently lowered the intensity of postoperative inflammatory responses and blood-aqueous barrier disruption. Nevertheless, even after uncomplicated low-risk cataract extraction, a certain degree of anterior chamber inflammation remains expected, and its adequate control is essential for achieving stable visual outcomes and preventing avoidable postoperative discomfort or delayed recovery. The high global surgical burden of cataract surgery, including millions of procedures performed annually in Europe alone, makes even mild postoperative inflammation clinically relevant because small differences in recovery patterns may affect a large number of patients (1,2). Postoperative inflammation after cataract surgery may present as aqueous flare, cellular reaction in the anterior chamber, corneal edema, increased central corneal thickness, ocular discomfort, photophobia, and transient reduction in visual clarity. Corneal edema occurs when excess stromal hydration leads to corneal clouding, and although it usually resolves within days to weeks, persistent or severe corneal thickening can compromise visual acuity and patient satisfaction. Inflammation within the anterior chamber may further affect corneal endothelial function, thereby increasing the risk or duration of corneal edema. For this reason, anti-inflammatory treatment remains an important component of postoperative cataract care, even in eyes considered low risk and in surgeries completed without intraoperative complications (3,4).

Aqueous flare is a clinically important marker of blood-aqueous barrier breakdown and reflects increased protein concentration within the aqueous humor. Traditionally, postoperative anterior chamber inflammation has been evaluated at the slit lamp through subjective grading of flare and cells, including cellular Tyndall assessment. However, laser flare photometry offers a more objective and quantitative method for measuring aqueous flare and allows a clearer assessment of inflammatory activity after surgery. Previous studies have shown that cataract surgery may lead to measurable increases in aqueous flare and central corneal thickness, even when the procedure is uneventful. These findings support the need for a rational postoperative anti-inflammatory regimen that is effective, practical, and safe for routine clinical use (5). Topical corticosteroids remain widely used after cataract surgery because they suppress inflammation at multiple levels of the inflammatory cascade. Dexamethasone acts by inhibiting phospholipase A2 and reducing the formation of prostaglandins and leukotrienes through effects on both cyclo-oxygenase and lipo-oxygenase pathways. In comparison with non-steroidal anti-inflammatory drugs, corticosteroids provide broader anti-inflammatory coverage and are particularly useful for controlling anterior chamber cellular activity and flare. However, the duration and intensity of steroid therapy after uncomplicated low-risk cataract surgery continue to vary across clinical settings. While prolonged corticosteroid use may increase concerns such as intraocular pressure elevation or delayed epithelial healing in susceptible patients, undertreatment may allow persistent inflammation that can delay recovery. Therefore, evaluating a defined three-week course of topical 0.1% dexamethasone provides clinically useful evidence for balancing efficacy with practical postoperative care (6,7).

Despite the routine use of topical steroids following cataract extraction, there remains a need for focused evidence on their effectiveness in uncomplicated low-risk cases using inflammatory indicators such as aqueous flare and cellular Tyndall assessment. Many patients undergoing modern cataract surgery have an excellent prognosis, yet postoperative inflammation may still influence comfort, corneal clarity, visual rehabilitation, and follow-up burden. Establishing whether topical 0.1% dexamethasone given for three weeks provides adequate control of anterior chamber inflammation can help guide clinicians toward a standardized and evidence-based postoperative regimen. Therefore, the present study was designed to determine the efficacy of topical 0.1% dexamethasone administered for three weeks after uncomplicated low-risk cataract extraction in terms of aqueous flare and cellular Tyndall assessment.

METHODS

This descriptive case series was conducted in the Department of Ophthalmology, Mayo Hospital, Lahore, over a six-month period from 11 May 2023 to 11 October 2023. The study was initiated after approval of the synopsis by the institutional Ethical Review Committee. All eligible participants were enrolled after obtaining written informed consent, and the study procedures were carried out in accordance with standard ethical principles for clinical research, including confidentiality of patient information, voluntary participation, and the right to withdraw from the study at any stage without affecting routine medical care. The sample size was calculated using the WHO sample size calculator. The calculation was based on an expected frequency of patients having no anterior chamber cells after treatment as 81.4%, with a 95% confidence level and 9% absolute precision. This yielded a required sample size of 80 patients. A non-probability consecutive sampling technique was used, and patients fulfilling the eligibility criteria were recruited from those presenting to the ophthalmology department for cataract extraction.

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Patients of either gender, aged 40 to 70 years, diagnosed with senile cataract and planned for cataract extraction with intraocular lens implantation were included. Only those patients whose cataract surgery remained uncomplicated were retained in the final analysis. Patients were excluded if they had diabetes mellitus with random blood sugar greater than 200 mg/dL, hypertension with blood pressure greater than 160/90 mmHg, ischemic heart disease, bronchial asthma, known drug allergy, connective tissue disease, vasculitis, immunological disorders, or any condition that could independently influence postoperative inflammation. Patients receiving anticoagulant therapy, systemic corticosteroids, or immunosuppressive treatment were also excluded. Additional exclusion criteria included mature senile cataract, complicated cataract, lens-induced glaucoma, poor compliance with postoperative treatment, intraoperative complications, or worsening of ocular condition during the follow-up period. After enrollment, all participants underwent a detailed preoperative ophthalmic assessment. Visual acuity was assessed using Snellen's visual acuity chart, intraocular pressure was measured with non-contact air-puff tonometry, and anterior segment evaluation was performed through slit-lamp examination. Preoperative ocular preparation was kept uniform for all patients to reduce variation in surgical and postoperative outcomes. Topical anesthesia was administered using 0.5% proparacaine hydrochloride before surgery. All cataract surgeries were performed in the same operating theatre by a single experienced surgeon, using similar surgical instruments and a standardized surgical technique, in order to minimize procedural bias and maintain consistency across the study population.

Following uncomplicated cataract extraction and intraocular lens implantation, all patients received topical dexamethasone 0.1% eye drops as the postoperative anti-inflammatory treatment. The eye drops were administered two-hourly during the initial three postoperative days, followed by six-hourly administration for one week, and then gradually tapered during the remaining follow-up period. Patients were followed for three weeks after surgery. At each follow-up visit, postoperative anterior chamber inflammation was assessed clinically by evaluating aqueous flare and cellular reaction. Grading was performed using Hogan's slit-lamp grading system under a 1 × 1 mm slit beam at 16× magnification. The main outcome of interest was the efficacy of topical 0.1% dexamethasone in controlling postoperative anterior chamber inflammation, assessed through aqueous flare and cellular Tyndall response after three weeks of treatment. Data were entered and analyzed using Statistical Package for Social Sciences version 25. Qualitative variables, including gender and treatment efficacy, were summarized as frequencies and percentages. Quantitative variables, including age and postoperative inflammatory parameters where applicable, were presented as mean ± standard deviation. Since anterior chamber cell and flare grades were assessed using a clinical grading system, categorical presentation of grades was also appropriate. Effect modifiers such as age and gender were stratified to evaluate their influence on treatment outcome. The chi-square test was applied for comparison of categorical variables after stratification. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study included 80 patients who underwent uncomplicated low-risk cataract extraction and completed three weeks of postoperative topical 0.1% dexamethasone therapy. The mean age of the patients was 57.63 ± 6.55 years, with ages ranging from 48 to 69 years. When categorized by age, 36 patients were in the 40–55 years age group, while 44 patients were in the 56–70 years age group. Among the total participants, 45 patients were male, representing 56.3% of the sample, while 35 patients were female, representing 43.7%. Regarding the operated eye, cataract extraction was performed on the right eye in 36 patients (45.0%) and on the left eye in 44 patients (55.0%). Nuclear sclerosis grade 2 was present in 27 patients, while nuclear sclerosis grade 3 was present in 53 patients.

Postoperative anterior chamber cellular reaction remained low after three weeks of topical dexamethasone therapy. The mean anterior chamber cell value was 0.05 ± 0.150, with a minimum value of 0.00 and a maximum value of 0.50. Overall treatment efficacy, assessed in terms of aqueous flare and cellular Tyndall response, was observed in 72 out of 80 patients, giving an efficacy rate of 90.0%. Treatment was not effective in 8 patients, representing 10.0% of the sample. When efficacy was stratified by age, 32 out of 36 patients aged 40–55 years showed treatment efficacy, giving a response rate of 88.9%, while 4 patients (11.1%) did not show efficacy. In the 56–70 years age group, 40 out of 44 patients demonstrated efficacy, with a response rate of 90.9%, while 4 patients (9.1%) did not demonstrate efficacy. The difference in efficacy between the two age groups was not statistically significant ($p = 0.764$).

Gender-based stratification showed that efficacy was achieved in 42 out of 45 male patients, corresponding to 93.3%, while 3 male patients (6.7%) did not show efficacy. Among female patients, efficacy was recorded in 30 out of 35 cases, corresponding to 85.7%, while 5 female patients (14.3%) did not show efficacy. The difference in treatment efficacy between male and female patients was not statistically significant ($p = 0.260$). When treatment efficacy was analyzed according to the side of the operated eye, 32 out of 36 right-eye cases showed efficacy, giving a response rate of 88.9%, while 4 cases (11.1%) did not show efficacy. In left-eye cases, efficacy was observed in 40 out of 44 patients, corresponding to 90.9%, while 4 patients (9.1%) did not show efficacy. The difference in efficacy between right and left eyes was not statistically significant ($p = 0.764$). Stratification by nuclear sclerosis grade showed that among patients with grade 2 nuclear sclerosis, efficacy was observed in 21 out of 27 patients, corresponding to 77.8%, while 6 patients (22.2%) did not show efficacy. Among patients with grade 3 nuclear sclerosis, efficacy was recorded in 51 out of 53 patients, corresponding to 96.2%, while 2 patients (3.8%) did not show efficacy. A statistically significant difference in treatment efficacy was recorded between nuclear sclerosis grade 2 and grade 3 groups ($p = 0.009$).

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Table: Descriptive Statistics of Age and Anterior Chamber Cells of Patients

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Age (years)	80	57.63	6.55	48.00	69.00
Anterior Chamber Cells	80	0.05	0.150	0.00	0.50

Table: Frequency Distribution of Gender and Operated Eye Side of Patients

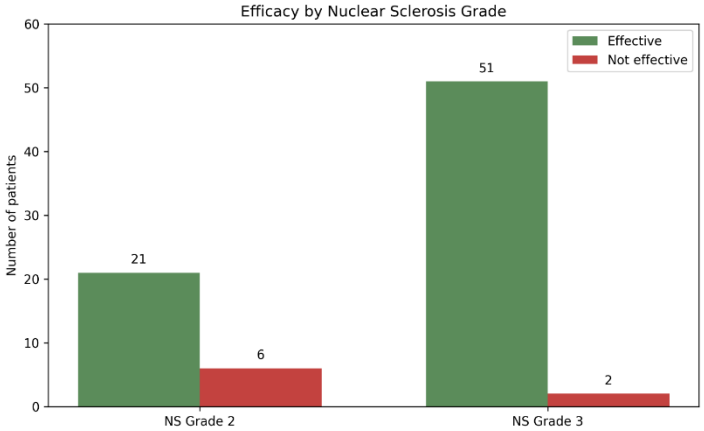
Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	45	56.3
	Female	35	43.7
Side of operated eye	Right	36	45.0
	Left	44	55.0

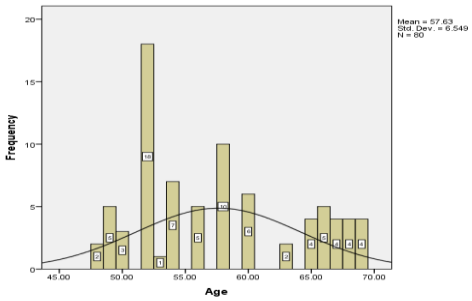
Table: Descriptive statistics of efficacy of topical 0.1 dexamethasone for 3 weeks after uncomplicated low risk cataract extraction in terms of aqueous flare and cellular Tyndall assessment of patients

Efficacy	N	80
	Yes	72
	%	90
	No	8
	%	10

Table: Association of Treatment Efficacy with Age, Gender, Operated Eye Side, and Nuclear Sclerosis Grade

Variable	Category	Efficacy Yes n (%)	Efficacy No n (%)	Total n (%)	p-value
Age (years)	40–55	32 (88.9%)	4 (11.1%)	36 (100%)	0.764
	56–70	40 (90.9%)	4 (9.1%)	44 (100%)	
Gender	Male	42 (93.3%)	3 (6.7%)	45 (100%)	0.260
	Female	30 (85.7%)	5 (14.3%)	35 (100%)	
Side of operated eye	Right	32 (88.9%)	4 (11.1%)	36 (100%)	0.764
	Left	40 (90.9%)	4 (9.1%)	44 (100%)	
Nuclear sclerosis grade	Grade 2	21 (77.8%)	6 (22.2%)	27 (100%)	0.009
	Grade 3	51 (96.2%)	2 (3.8%)	53 (100%)	





Descriptive statistics of age of the patients

DISCUSSION

The present study evaluated the efficacy of topical 0.1% dexamethasone administered for three weeks after uncomplicated low-risk cataract extraction, with postoperative inflammation assessed through aqueous flare and cellular Tyndall response. The findings showed that 90.0% of patients achieved the predefined treatment efficacy, while only 10.0% did not demonstrate an adequate response. The mean anterior chamber cell value after treatment was low, recorded as 0.05 ± 0.150, suggesting that postoperative anterior chamber cellular activity remained minimal in most patients after the three-week steroid regimen. These findings supported the clinical role of topical dexamethasone as an effective postoperative anti-inflammatory agent in low-risk cataract surgery, although the absence of a comparison group limited the ability to determine whether this response was superior to alternative anti-inflammatory regimens or to the natural postoperative course. Modern cataract surgery has become less invasive because of improvements in surgical techniques, intraocular lens implantation, wound construction, and perioperative care. These advances have reduced surgical trauma and lowered the degree of postoperative blood-aqueous barrier disruption, yet inflammatory activity may still occur even after uncomplicated surgery. Aqueous flare represents increased protein concentration in the anterior chamber and reflects breakdown of the blood-aqueous barrier, while cellular Tyndall response indicates inflammatory cell activity. Persistent inflammation may contribute to discomfort, photophobia, corneal edema, delayed visual recovery, and, in selected cases, macular changes. Therefore, even in low-risk cataract extraction, adequate postoperative control of inflammation remains an important clinical objective (8-10).

The mean age of the study population was 57.63 ± 6.55 years, with a range from 48 to 69 years. This age distribution was consistent with the expected presentation of senile cataract in routine ophthalmic practice. When treatment efficacy was stratified by age, patients aged 40–55 years showed an efficacy rate of 88.9%, while those aged 56–70 years showed an efficacy rate of 90.9%. The difference was not statistically significant, indicating that the response to topical dexamethasone remained broadly comparable across the two age groups included in this study. Previous studies evaluating postoperative outcomes after cataract surgery have also emphasized inflammatory control as an important determinant of recovery; however, direct comparison remained difficult where age-specific response data were either not reported or were not analyzed in relation to dexamethasone efficacy (11-13). The study population included 45 males and 35 females, representing 56.3% and 43.7% of the sample, respectively. Treatment efficacy was achieved in 93.3% of male patients and 85.7% of female patients, but this difference was not statistically significant. This finding suggested that gender did not appear to meaningfully influence the anti-inflammatory response to topical 0.1% dexamethasone in the present sample. Although the slightly higher response rate among males was numerically visible, the descriptive nature of the study and the limited sample size did not support any gender-based conclusion. Previous literature on postoperative cataract inflammation has generally focused more on ocular inflammation, macular thickness, and visual acuity than on gender-specific therapeutic response, which restricted direct comparison with the present findings (13-15).

The operated eye was the right eye in 45.0% of patients and the left eye in 55.0%. Efficacy was observed in 88.9% of right-eye cases and 90.9% of left-eye cases, with no statistically significant difference between the two groups. This finding indicated that laterality did not affect the response to topical dexamethasone. Clinically, this was expected because postoperative inflammation after cataract extraction is more closely related to surgical trauma, ocular comorbidity, operative difficulty, and postoperative medication adherence than to the side of the eye itself. The slightly higher number of left-eye cases reflected sample distribution rather than a clinically meaningful asymmetry. A key finding of the present study was the significant association between nuclear sclerosis grade and treatment efficacy. Among patients with grade 2 nuclear sclerosis, efficacy was achieved in 77.8%, whereas patients with grade 3 nuclear sclerosis showed a higher efficacy rate of 96.2%. The difference was statistically significant. This result required cautious interpretation because greater nuclear sclerosis is often associated with relatively more surgical manipulation and potentially higher postoperative inflammation. A higher efficacy rate in grade 3 nuclear sclerosis may therefore reflect differences in case selection, baseline

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inflammatory status, surgical factors, postoperative compliance, or the small number of non-effective cases rather than a direct biological advantage in more advanced nuclear sclerosis. Further analytical studies with baseline flare values, operative time, ultrasound energy, surgical difficulty, and postoperative follow-up measurements would be required to clarify this association.

The overall efficacy rate of 90.0% in the present study was broadly consistent with the known anti-inflammatory action of topical corticosteroids after cataract surgery. Dexamethasone suppresses inflammation through inhibition of phospholipase A2 and subsequent reduction in prostaglandin and leukotriene production, thereby influencing both cyclo-oxygenase and lipo-oxygenase pathways. Previous literature has shown that topical corticosteroids reduce anterior chamber inflammation after cataract surgery and remain widely used in postoperative regimens. However, several studies have also reported comparable anti-inflammatory effects with topical non-steroidal anti-inflammatory drugs, particularly in relation to macular thickness and cystoid macular edema prevention. These differences indicated that corticosteroids and NSAIDs may have overlapping but not identical roles in postoperative cataract care (15-17). A previous comparative study involving patients undergoing low-risk cataract surgery assessed short-term topical bromfenac and dexamethasone therapy and reported comparable control of anterior chamber inflammation between the two groups. That study also showed similar improvement in visual acuity and macular thickness outcomes across treatment arms. In comparison, the present study focused only on topical 0.1% dexamethasone and found a high rate of postoperative inflammatory control. Although both studies supported the usefulness of anti-inflammatory treatment after cataract surgery, direct comparison remained limited because the present study did not include a bromfenac group, did not assess macular thickness, and did not provide serial postoperative inflammatory grading at multiple time points (18-20).

The findings had practical clinical relevance because a three-week topical dexamethasone regimen appeared to provide adequate postoperative inflammatory control in most low-risk patients after uncomplicated cataract extraction. In settings where patient follow-up, affordability, and medication availability are important concerns, a clearly defined steroid regimen may help standardize postoperative care and reduce unnecessary variation in treatment practice. However, the results should not be interpreted as evidence that dexamethasone was superior to other steroid preparations, NSAIDs, combined regimens, or shorter treatment schedules. The study supported efficacy within the observed group but did not establish comparative effectiveness. The study had several strengths. It included a clearly defined low-risk cataract population, used a fixed postoperative dexamethasone regimen, and maintained surgical consistency by having procedures performed by a single surgeon in the same operating environment. The use of standardized slit-lamp assessment and defined follow-up duration also improved procedural uniformity. Demographic and clinical stratification by age, gender, side of eye, and nuclear sclerosis grade allowed basic evaluation of potential effect modifiers.

The study also had important limitations. The descriptive case series design lacked a control or comparison group, which limited causal inference. The study did not compare dexamethasone with NSAIDs, placebo, combination therapy, or alternative steroid regimens. Aqueous flare was described clinically, but objective measurement using laser flare photometry was not reported, despite its recognized value for quantifying blood-aqueous barrier disruption. The Results section also did not provide separate detailed distributions of aqueous flare grades and cellular Tyndall grades before and after treatment. Similarly, serial postoperative findings at different follow-up points were not available, which restricted understanding of the time course of inflammatory resolution. Adverse effects such as steroid-induced intraocular pressure rise, delayed epithelial healing, ocular irritation, infection, or treatment intolerance were not reported. Medication compliance was also not objectively measured, although it could have influenced efficacy. Another limitation was the operational definition of “efficacy,” which needed clearer description. The study would have been stronger if efficacy had been defined using precise thresholds, such as complete absence of anterior chamber cells, reduction to trace or grade 0 flare, or a predefined improvement from baseline. The use of anterior chamber cell values as mean ± standard deviation also required caution because slit-lamp grading systems usually produce ordinal data rather than true continuous measurements. Future studies should consider presenting categorical inflammatory grades along with appropriate non-parametric or ordinal statistical methods.

Overall, the present study showed that topical 0.1% dexamethasone for three weeks was associated with a high rate of postoperative inflammatory control after uncomplicated low-risk cataract extraction. The findings added useful local clinical data and supported the continued role of topical corticosteroids in routine postoperative care. However, stronger evidence would require randomized controlled trials with larger samples, objective laser flare photometry, baseline and serial postoperative assessments, macular thickness evaluation by optical coherence tomography, intraocular pressure monitoring, compliance assessment, and direct comparison with NSAIDs or combined anti-inflammatory regimens.

CONCLUSION

Topical 0.1% dexamethasone used for three weeks after uncomplicated low-risk cataract extraction was found to be effective in controlling postoperative anterior chamber inflammation, as reflected by improvement in aqueous flare and cellular Tyndall response. The findings support its practical value as a postoperative anti-inflammatory regimen in routine cataract care, particularly for patients without major systemic or ocular risk factors. Although the study adds useful local clinical evidence, further comparative research with

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objective inflammatory measurements and longer follow-up would help strengthen treatment guidelines and clarify the most appropriate postoperative anti-inflammatory protocol.

AUTHOR CONTRIBUTION

Author	Contribution
Dr. Muhammad Qasim Yazar	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Dr Bahadur Iftikhar	Methodology, Investigation, Data Curation, Writing - Review & Editing
Dr Saima Khalid	Investigation, Data Curation, Formal Analysis, Software
Dr. Wazir Muhammad Hasan	Software, Validation, Writing - Original Draft

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