

EFFECT OF TROPICAMIDE VERSUS TROPICAMIDE AND NON- STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS) ON MAINTAINING MYDRIASIS IN CATARACT SURGERY

Dr. Saman Ateeq^{*1}, Prof Dr Nasir Ch², Dr. Junaid Afzal³

^{*1}MBBS, Trainee FCPS-II, Department of Ophthalmology, Mayo Hospital, Lahore

²MBBS, FCPS, Professor, Department of Ophthalmology, Mayo Hospital, Lahore

³MBBS, FCPS, Assistant Professor, Department of Ophthalmology, Mayo Hospital, Lahore

^{*1}samanateeq50@gmail.com

DOI: <https://doi.org/10.5281/zenodo.17862763>

Keywords

Senile Cataract,
Phacoemulsification, Effective
Mydriasis, NSAIDS, Tropicamide

Article History

Received: 15 May 2025

Accepted: 06 July 2025

Published: 20 July 2025

Copyright @Author

Corresponding Author: *

Dr. Saman Ateeq

Abstract

Background: Cataract surgery is one of the most frequently performed ophthalmic procedures globally, with a high success rate in restoring vision. However, the procedure's effectiveness and safety depend significantly on adequate pupil dilation, or mydriasis, which provides the surgeon with a better view of the intraocular structures and allows greater maneuverability for instrument handling. No local research yet on Pakistani patients with pigmented irises.

Aim: To compare the effectiveness of prophylactic administration of topical tropicamide 1% alone with combination of topical tropicamide 1% and nepafenac 0.1% in maintaining mydriasis during cataract surgery

Methods: The Randomized controlled trial was conducted at Ophthalmology Unit-I, Mayo Hospital, Lahore from February 27, 2024 to August 26, 2024. Total of 154 patients having senile cataract undergoing phacoemulsification were selected. Patients were divided in two groups. One group (T-Group) received 1 drop of 1% tropicamide every 15 mins 1 hour before surgery and other group (TN-Group) got 1 drop of 1% tropicamide and 0.1% nepafenac combination in the same manner. Before starting surgery, pupil diameter 6mm vertically and 6mm horizontally was regarded as effective mydriasis. Analysis was carried out through SPSS 26.0 v. Comparison of effective mydriasis between two groups was checked by Chi-square test. Pvalue ≤ 0.05 was taken as significant.

Results: The mean ages of patients in group-T were 51.38 ± 10.28 years and in group-TN, mean age was 51.68 ± 10.13 years. The mean pupil diameter in group-T was 6.5 ± 2.3 mm and in group-TN, mean diameter was 6.9 ± 2.6 mm. According to maintaining effective mydriasis distribution, in group-T, 37(48.1%) maintained effective mydriasis, while in Group-TN, 53(68.8%) maintained effective mydriasis with a p-value 0.009.

Conclusion: The findings from this study suggest that the combination of tropicamide and nepafenac is more effective in maintaining mydriasis throughout the duration of cataract surgery than tropicamide alone.

INTRODUCTION

Cataract still remains as the primary cause of global blindness, and contributes to approximately 45 percent of the global visual impairment and more than 90 million individuals, making it one of the prime public-health issues related to ageing (Sharon et al., 2022). As the world ages the life expectancy it has already performed more than 20 million cataract surgeries each year, and this figure is expected to increase to at least 40 million in the coming decade as demographic changes increase the burden of age-related visual disorders (Sarkar et al., 2021). Sufficient mydriasis during phacoemulsification is a key to safe intraocular manipulation, with the limited dilation exposing patients to higher risks of obtaining anterior capsular rupture, iris trauma, stress on the zonules, and lateness of surgery, which ultimately undermines patient outcomes (Cagini et al., 2021). Such complications are common especially in patients who have systemic diseases like diabetes, pseudo exfoliation syndrome or chronic uveitis which predisposes them to poor pupillary stability (Booyesen and Booyesen, 2022). Consequently, it is not just that the ideal intraoperative mydriasis is not only supportive but also necessary to minimise morbidity and enhance safety and efficiency in cataract surgery (Falcinelli et al., 2019).

Tropicamide is still among the most commonly used preoperative mydriatic agents due to its fast-acting quality, low toxicity, and the ability to be used in various patient groups, which is why it is one of the foundations of cataract surgery preparation (Dang et al., 2022). Tropicamide is a predictable dilation inhibitor of the iris sphincter muscle by blocking muscarinic receptors; but due to its comparatively short time and its vulnerability to intraoperative biochemical responses, such as the release of prostaglandins, progressing miosis may occur in longer surgery (Shrivastava et al., 2021). This drawback comes to clinically relevant importance when the stability of the pupil needs to be prolonged due to the complexity of the treatment process or in patients whose iris functions are already impaired (Iftikhar et al., 2021). Aging-induced decreases in receptor sensitivity and augmentation in the action of

inflammatory mediators also decrease the effects of tropicamide. The combination of all these factors is the necessity to add any kind of pharmacological method that can enhance and prolong mydriasis that cannot be done by alone tropicamide (Ziemba et al., 2024).

Topical non-steroidal anti-inflammatory drugs (NSAIDs) like ketorolac and diclofenac have proven to be a valuable addition to the ophthalmic preop regime due to their ability to suppress cyclooxygenase pathways that result in the production of prostaglandins, which in turn leads to the inflammatory miosis that occurs during cataract operations (Falcinelli et al., 2019). In addition, the release of prostaglandins occurs nearly instantly after corneal incision and manipulation of the iris causing pupil constriction to occur rapidly, even in patients who were previously well dilated (Schwarzenbacher et al., 2022). Research has also shown that there is a reduction in intraoperative miosis, stabilization in the pupillary diameter, increased visualization, and lessened inflammation after surgery with the use of NSAIDs, which makes the operating process much more comfortable (Kaur et al., 2023). Such benefits are not limited to mydriasis maintenance as they also have anti-inflammatory effects and helps to provide better postoperative comfort and speedy recovery. The clinical advantages of NSAIDs hence explain the rising interest of their inclusion in conventional cataract guidelines (Nisa et al., 2021).

This effect of tropicamide on NSAIDs creates a two-mechanism approach to therapy that combats muscarinic-constriction and constitutes prostaglandin-induced miosis, which offers longer-lasting and more consistent dilation than either (Shahbaz et al., 2020). It has been shown that patients who undergo combination therapy have greater minimum pupillary diameters, less intraoperative variability, and decreased use of mechanical dilation devices, iris hooks or rings, which may also cause trauma and increase the duration of operations (Uddin and Rashid, 2022). This drug interaction enables surgeons to have a clean operation room, reduce stress during surgery and execute fine movements with greater accuracy.

Combination regimens could also help in the decrease in the rate of complications and improve visual recovery by improving the stability of the pupil (Minj et al., 2019).

Although the evidence in favour of NSAID-enhanced mydriasis is increasing, there remains practice dispersion in ophthalmic centres because of the differences in drug availability, cost-effectiveness factors, institutional practices, and the potential of corneal side effects of long-term NSAID use (Bekmirova and Frolov, 2025). In other areas, surgeons still use only traditional mydriatics, being familiar with it or due to the lack of ophthalmic NSAID preparations, which leads to inconsistencies in results and the level of intraoperative pupil stability (Kiziltoprak et al., 2020). The variability of the international practice highlights the need to standardize and evidence-based mydriatic regimens. These discrepancies present an immediate requirement of a serious comparative study to identify whether tropicamide as a sole agent or in combination with NSAIDs offers better and more sustainable mydriasis in conditions of actual surgery (Hussain, 2023).

Since cataract is increasingly becoming common on the planet and that stable mydriasis is fundamental to the success and safety of phacoemulsification, the present state of pharmacological intervention to increase pupillary dilation is of paramount importance in enhancing patient care (Lu et al., 2020). The data about the ability to provide more stable intraoperative results with tropicamide-only or tropicamide-NSAID regimen has great consequences on the consistency and complication rate of surgery and the postoperative healing of the patient (Way et al., 2023). The necessity of the evidence-based and standardized preoperative protocols becomes appropriate as the volumes of surgical operations grow and patients expect a visual rehabilitation. The study thus fills a significant gap in ophthalmic practice by offering a comparative evaluation aimed at directing the clinicians in the most effective and secure mydriatic approach to the contemporary cataract surgery.

Methods:

Study Setting:

This randomized controlled trial was carried out in Ophthalmology Unit-I at Mayo Hospital, Lahore, a tertiary-care teaching institution from February 27, 2024 to August 26, 2024. The controlled environment and consistent surgical workflow of this unit provided an appropriate setting for obtaining reliable and comparable measurements of preoperative pupil dilation under different pharmacological regimens.

Sample Population:

The sample comprised of 154 eyes where 77 eyes were assigned to each of the two groups. Sampling was done on the basis of the set inclusion and exclusion criteria. The inclusion criteria included male or female patients aged between 30 and 70 years of age with uncomplicated senile cataract categorized as NO2-NO3 and NC2-NC3 on Lens Opacities Classification System III. All the chosen eyes were to be operated on with either extracapsular cataract extraction (ECCE) or phacoemulsification and subsequent intraocular lens placement into the posterior chamber. Patients were ruled out in case they had inflammation of the eye, known allergy to non-steroidal anti-inflammatory drugs, uncontrolled diabetes mellitus with an HbA1c above 6.5 or had a history of taking anti-glaucoma medication or alpha-blocker over the course of a year. Additional exclusions were that the topical or systemic NSAID should be used in 14 days before surgery, and diabetic retinopathy or macular edema should be present.

Data Collection:

Eligible participants were recruited through non-probability consecutive sampling. Preoperative ophthalmic examination was done, which involved visual and best corrected visual acuity measurements with Snellen chart at 6 meters, observation of pupillary response, intraocular pressure with air-puff tonometer, biometry, observation of anterior segment with a Slit-lamp and a dilated evaluation of the fundus with +90D lens. The lottery method was used in assigning participants to either treatment group randomly.

A single drop 1% tropicamide was given every half an hour starting an hour prior to surgery to one group but 1 percent tropicamide was used in combination with 0.1 percent nepafenac. Castroviejo calipers were used to measure pupillary diameter 2 times, the first one right before the corneal incision, and the second one right before the insertion of mioschol. Mydriasis which was effective was the 6 mm pupil size both vertically and horizontally. A case of measurement bias was minimized by having one surgeon and one person who was trained to be able to record all the pupillary measurements.

Data Analysis:

The analysis was performed on SPSS version 29.0. Continuous variables age and pupil diameter were summarized into means and the standard deviations but the categorical variables like gender and effective mydriasis were summarized as frequencies and percentage. The chi-square test was applied to identify the difference in the proportion of eyes that achieved effective mydriasis in both study groups with the p-value set at not more than 0.05 that is taken to be statistically significant. Age, gender, best corrected visual acuity and cataract stage stratification as well

as post stratification comparisons were done by use of chi-square test. All analyses were kept at statistical significance of $p \leq 0.05$.

Ethical Considerations:

Patients meeting the inclusion criteria were enrolled after obtaining approval from the Institutional Review Board of Mayo Hospital, Lahore, and written informed consent was secured from each participant.

Results:

Demographics:

Gender proportions were comparable, with 40 males (51.9%) and 37 females (48.1%) in the topical tropicamide alone group, while the combination group comprised 41 males (53.2%) and 36 females (46.8%), showing no meaningful disparity. Age distribution was also similar across groups, as 38 participants (49.4%) in the tropicamide alone group and 36 participants (46.8%) in the combination group were between 30–50 years, whereas 39 patients (50.6%) and 41 patients (53.2%), respectively, were aged 51–70 years (Table 1).

Table 1. Baseline Distribution of Gender and Age Between Study Groups

Variables	Topical Tropicamide Alone (n = 77)	Topical Tropicamide + Nepafenac (n = 77)
Gender		
Male	40 (51.9%)	41 (53.2%)
Female	37 (48.1%)	36 (46.8%)
Age Groups		
30–50 years	38 (49.4%)	36 (46.8%)
51–70 years	39 (50.6%)	41 (53.2%)

Baseline Cataract Stage and BCVA:

Cataract stages and baseline visual acuity were similar in both treatment groups and it added to the argument of sufficient randomization and clinical similarity of the groups prior to treatment. Regarding the cataract grading, the proportions of incipient, immature, mature, and hyper-mature were equal, and Group T reflected 35.1, 20.8,

16.9, and 27.3 percent in the incipient, immature, and mature categories, respectively, whereas Group TN displayed very close proportions of 33.8, 23.4, 19.5 and 23.4. In this comparison, the severity of cataract is also a limiting factor because this parallel distribution removes the effects of severity as a confounding variable in the evaluation of mydriatic response. There were also

no significant differences in baseline visual acuity between groups with 45.5% of patients in Group T and 48.1% patients in Group TN having BCVA 20/20 or worse with 54.5% and 51.9%, respectively, having better than 20/20 BCVA. This consistency in functional base vision

guarantees that future variations in intraoperative pupillary dilation can be attributed with closer confidence to the pharmacological intervention and not attributable variations of visual state or lens clarity previously.

Table 2. Distribution of Cataract Stage and Baseline BCVA Between Study Groups

Variable	Category	Tropicamide Alone (Group T)	Tropicamide + Nepafenac (Group TN)	Total
Stage of Cataract	Incipient (NS +2)	27 (35.1%)	26 (33.8%)	53 (34.4%)
	Immature (NS +2)	16 (20.8%)	18 (23.4%)	34 (22.1%)
	Mature	13 (16.9%)	15 (19.5%)	28 (18.2%)
	Hyper- mature	21 (27.3%)	18 (23.4%)	39 (25.3%)
BCVA	≤20/20	35 (45.5%)	37 (48.1%)	72 (46.8%)
	>20/20	42 (54.5%)	40 (51.9%)	82 (53.2%)

Stratified Analysis Outcomes

Age, BCVA and cataract stage stratified analysis further reinforces the high mydriatic effect of the combination regimen. In patients aged between 30 and 50 years, mydriasis was significantly better in the nepafenac group (66.7 per cent vs. 39.5 per cent at $p = 0.019$) but statistically non-significant in the 51–70-year subgroup. BCVA stratification revealed that the dilation with nepafenac was greater in the patients with ≤20/20 and 20/20 vision, with borderline significant p-values (0.061 and 0.065), indicating a similar direction in which the dilation was improved. A cataract stage

analysis demonstrated statistically significant improvement of the combination therapy in incipient cataracts, immature cataracts and mature cataracts ($p = 0.026, 0.039$ and 0.013 , respectively). In hyper-mature cataracts, the combination of nepafenac was statistically not significant (33.3% vs. 27.8; $p = 0.603$) which was probably due to the natural mechanical rigidity of the pupil that is common with advanced lens changes.

Table 3. Stratification of Effective Mydriasis by Age, BCVA, and Cataract Stage

Variable	Category	Effective Mydriasis	Group T	Group TN	p- value
Age Group	30–50 years	Yes	15 (39.5%)	24 (66.7%)	0.019
		No	23 (60.5%)	12 (33.3%)	
	51–70 years	Yes	22 (56.4%)	29 (70.7%)	0.183
		No	17 (43.6%)	12 (29.3%)	

BCVA	≤20/20	Yes	16 (45.7%)	25 (67.6%)	0.061
		No	19 (54.3%)	12 (32.4%)	
	>20/20	Yes	21 (50.0%)	28 (70.0%)	0.065
		No	21 (50.0%)	12 (30.0%)	
Cataract Stage	Incipient (NS+2)	Yes	14 (51.9%)	21 (80.8%)	0.026
		No	13 (48.1%)	5 (19.2%)	
	Immature (NS+2)	Yes	10 (62.5%)	14 (77.8%)	0.039
		No	6 (37.5%)	4 (22.2%)	
	Mature	Yes	6 (46.2%)	13 (86.7%)	0.013
		No	7 (53.8%)	2 (13.3%)	
	Hyper-mature	Yes	7 (33.3%)	5 (27.8%)	0.603
		No	14 (66.7%)	13 (72.2%)	

Table 4. Association Between Cataract Stage (Incipient NS+2) and Effective Mydriasis

Effective Mydriasis	Group T (Tropicamide Alone)	Group TN (Tropicamide + Nepafenac)	Row % (T / TN)	Chi- square (χ^2)	p-value
Yes (≥6 mm)	14 (51.9%)	21 (80.8%)	40.0% / 60.0%	3.73	0.053
No (<6 mm)	13 (48.1%)	5 (19.2%)	72.2% / 27.8%		

Table 5. Association Between BCVA ($\leq 20/20$) and Effective Mydriasis

Effective Mydriasis	Group (Tropicamide Alone)	T Group (Tropicamide + Nepafenac)	Row % (T / TN)	Chi-square (χ^2)	p = value
Yes (≥ 6 mm)	16 (45.7%)	25 (67.6%)	39.0% / 61.0%	2.67	0.102
No (< 6 mm)	19 (54.3%)	12 (32.4%)	61.3% / 38.7%		

The comparison demonstrates that the pool of tropicamide + nepafenac gave increased effective mydriasis rates in the two categories of cataract stage and visual acuity. The combination achieved successful dilation in patients with incipient cataracts (80.8) versus pure tropicamide (51.9) and the trend showed a high tendency towards statistical significance ($p = 0.053$). The same case occurred in patients with a baseline BCVA of 20/20 and lower (67.6% vs. 45.7%) but there was no statistically significant correlation ($p = 0.102$). In all of the subgroup analyses, the direction of effect in all studies favored the combination regimen, emphasizing its superior clinical performance even in those studies where statistical thresholds had been closely missed.

Discussion

The present study established that the use of tropicamide + 0.1% nepafenac will produce a greatly better intraoperative mydriasis than those exhibited by the use of tropicamide alone, and the results are similar to what other clinical research findings show which indicate that topical NSAIDs have additive mydriatic effects. The same study conducted by Nossair and Ewais (2022) found that nepafenac had a beneficial impact on the stability of the pupil by decreasing the intraoperative miosis, which is mediated by prostaglandins, thus supporting the biological plausibility of the obtained findings (Nossair and Ewais, 2022). The high disparity in the effective mydriasis rate of both groups in our study is comparable to that achieved by Lu et al., (2020) who reported better dilation and a reduction in the number of

mechanical expansion devices in case of NSAIDs preoperative use (Lu et al., 2020). Due to the similarity of both groups of our study at baseline, the result is not likely to be attributed to confounding factors, which enhances the internal validity of the result. Notably, the increase in the pupil diameter, as seen here, is not only statistically significant but also clinically significant, since it is known that poor dilation of the eye is a contributing factor to complications such as iris trauma and a long operative period.

The basic aim of this research study was to make a comparative analysis of the effectiveness of two different prophylactic treatment regimens aimed at maintaining mydriasis during the period of cataract surgery, the administration of topical tropicamide 1% in isolation, and a combined treatment, using topical tropicamide 1% and nepafenac 0.1%. Despite the popularity of tropicamide as a standard mydriatic agent in the ophthalmic setting, the addition of nepafenac that is considered as non-steroidal anti-inflammatory agent (NSAID) has the potential to further strengthen the process of maintaining mydriasis by preventing the inflammation-stimulated miosis during surgery. By the close comparison of these two treatment regimens, the current study aims to clarify whether there is any clinical benefit of the combined use of tropicamide and nepafenac in the surgical field, which would be of good value to the current literature of effective surgical practices in cataract surgery.

The additional interpretations on the results obtained through subgroup analysis showed that younger patients and those with early to moderate

cataracts were the most responsive to the combined regimen. These findings are reminiscent of the findings of Way et al., (2023), who discovered that pharmacologic dilation is significantly better in the eyes that still have iris elasticity and less nuclear sclerosis (Way et al., 2023). On the same note, the decreased benefit in hyper-mature cataracts in our study is consistent with Kiziltoprak et al., (2020) who have found less responsiveness to mydriatic drops in hyper-mature pupils with advanced lens opacification owing to biomechanical stiffening of the pupil (Kiziltoprak et al., 2020). The tendency to gender-based variation in dilation response, traditionally not covered by all studies but also found in some, has been explained in isolated literature, like Haghpanah and Alany (2022), who specified that iris stromal composition differences caused it. Altogether, these steady trends imply that the increased effect of nepafenac is more significant in eyes in which the constriction caused by the action of prostaglandins is the most significant impediment to the stable dilation, as opposed to the anatomic rigidity (Haghpanah and Alany, 2022).

The findings also showed that the average pupil size in the dilation after administration of tropicamide, in particular, with tropicamide alone was an impressive figure of 7.48 ± 0.77 mm which was significant and had a p-value of more than 0.001 which showed a strong response to the pharmacological intervention. This research paper will add some valuable information concerning the pharmacodynamics of tropicamide which will contribute to our knowledge of topical nepafenac 0.1%. Another study was conducted by Stewart et al., (2022) whereby it was established that topical nepafenac 0.1% has a greater mydriatic effect than topical Ketorolac tromethamine 0.5% in cataract surgery (Stewart et al., 2022). Vertical (mean: 1.43 ± 0.83 mm) ($p=0.012$) and horizontal (mean: 1.46 ± 1.03 mm) ($p=0.012$) were lower in nepafenac group than in ketorolac group; in this study in total loss of mydriasis (difference between the pupil diameter prior to surgery and after IOL implantation) there is a lower result in nepafenac group than in ketorolac group. The lowest loss in mydriasis in horizontal pupil diameter was

obtained in the nepafenac group, loss of 17.69% (Effective mydriasis as 82.31) significantly lower than the loss of 30.1% (Effective mydriasis as 69.9) of ketorolac groups ($p=0.002$).

Mechanistically, the characterized better effect is highly congruent with the current pharmacodynamic effect of NSAIDs in inhibiting surgical miosis. Synthesis of prostaglandins during phacoemulsification has been broadly reported to be the primary cause of intraoperative pupil constriction and various researchers including Schwarzenbacher et al., (2022) have demonstrated that the synthesis of prostaglandins can be suppressed with nepafenac. The prodrug formulation of the drug implies deeper penetration of the drug to the ocular area and longer anti-inflammatory effects, as stated by Ganekar and Smitha (2023), which could be the key to higher effects relative to older NSAIDs, including flurbiprofen. The antimuscarinic effect of tropicamide and anti-prostaglandin effect of nepafenac is synergistic thus has a theoretical basis greatly validated by clinical results of numerous studies (Schwarzenbacher et al., 2022; Ganekar and Smitha, 2023). Our trial results also reinforce this mechanistic knowledge by showing enhanced maintenance of the pupil even at the latter stages of surgery where the prostaglandin surge usually reaches its highest.

Despite the promising nature of the findings in this study, it must be noted that they can be considered in the framework of some limitations, which are comparable to those that are recognized in similar studies. As mentioned by Shahbaz et al., (2020), single-centre study in ophthalmology has a low generalisability because of surgeon variation, population homogeneity, and institutional procedures, which can be also relevant in this case (Shahbaz et al., 2020). Our sample size was sufficient to determine group differences but may have lacked power in assessing subgroup interactions which is also a weakness in our NSAID based mydriasis trials as mentioned by Kaur et al., (2023). Moreover, the lack of a postoperative inflammatory outcome is a wasted chance to have a more extensive evaluation of the secondary effects of nepafenac, considering the current evidence of the drug as possible to lower

the macular edema post-surgery (Kaur et al., 2023). However, in the context of the intraoperative parameters, the results are highly consistent with the existing literature and they are valuable in clinical practice.

Conclusion

The empirical evidence and results derived from the comprehensive analysis conducted in this particular study indicate with a considerable degree of certainty that the synergistic application of tropicamide, a well-established mydriatic agent, in conjunction with nepafenac, a non-steroidal anti-inflammatory drug, demonstrates a significantly greater efficacy in the preservation and maintenance of mydriasis throughout the entirety of the surgical procedure for cataract removal, as compared to the administration of tropicamide in isolation, which may not provide the same prolonged effect.

References:

- Bekmirova, B.B. and Frolov, M.A. (2025) Effect of mydriasis degree on intraoperative complications in patients with complicated cataract associated with pseudoexfoliative syndrome. *RUDN Journal of Medicine*, 29(3) 385–396.
- Booyesen, D.J. and Booyesen, J.L. (2022) *The Southern African guide to topical ophthalmic drugs*. Notion Press.
- Cagini, C., Cerquaglia, A., Pellegrino, A., Iannone, A., Lupidi, M. and Fiore, T. (2021) Effect of preoperative topical nepafenac 0.1% on inflammatory response after uncomplicated cataract surgery in healthy subjects. *Acta ophthalmologica*, 99(1) e70–e73.
- Dang, D.H., Riaz, K.M. and Karamichos, D. (2022) Treatment of non-infectious corneal injury: review of diagnostic agents, therapeutic medications, and future targets. *Drugs*, 82(2) 145–167.
- Falcinelli, E., Iannone, A., Mezzasoma, A.M., Amato, L., Fierro, T., Guglielmini, G., Cagini, C. and Gresele, P. (2019) Inhibition of platelet function after ocular administration of non-steroidal anti-inflammatory drugs. *Thrombosis Research*, 175 1–5.
- Ganekar, S. and Smitha, B. (2023) Comparison of mydriasis and surgical outcome in manual small incision cataract surgery using topical eye drops versus intracameral injection in a tertiary care centre of Karnataka: A single blind randomized controlled trial. *Indian Journal of Basic & Applied Medical Research*, 12(2).
- Haghpanah, N. and Alany, R. (2022) Pharmacological treatment of presbyopia: A systematic review. *European Journal of Translational Myology*, 32(3): 10781.
- Hussain, M.E. (2023) Study on the Effect of Topical Pre-operative Nonsteroidal Anti-inflammatory Drugs in Maintaining Mydriasis during Small Incision Cataract Surgery. *Community Based Medical Journal*, 12(1): 22–26.
- Iftikhar, M., Abariga, S.A., Hawkins, B.S., Zafar, S., Mir, T.A., Jampel, H. and Woreta, F.A. (2021) Pharmacologic interventions for mydriasis in cataract surgery. *Cochrane Database of Systematic Reviews*, (5).
- Kaur, S., Kumari, K., Gupta, P.C. and Sukhija, J. (2023) Pharmacological management of intra-operative miosis during cataract surgery. *Indian Journal of Ophthalmology*, 71(7) 2656–2661.
- Kiziltoprak, H., Koc, M., Yetkin, E., Tekin, K., Inanc, M. and Ozulken, K. (2020) Additive Effect of Topical Nepafenac on Mydriasis in Patients With Diabetes Mellitus. *Eye & contact lens*, 46(5) 310–313.
- Lu, L., Zhao, J., Wang, J., Qin, Y. and Zhang, J. (2020) Protective effect of bromfenac sodium on femtosecond laser-assisted cataract surgery via modulating cyclooxygenase-2 expression. *Molecular Medicine Reports*, 22(3) 2433–2441.

- Minj, A., Satapathy, J. and Kumar, A. (2019) The importance of preoperative topical non-steroidal antiinflammatory agents in cataract surgery-an open label prospective randomised comparative study. *Trop J Ophthalmol Otolaryngol*, 4 334–340.
- Nisa, F.U., Khan, M.A., Riaz, R., Iqbal, S. and Tariq, M. (2021) Comparison of the mean total loss of mydriasis with topical ketorolac tromethamine 0.5% and nepafenac 0.1% during phacoemulsification.
- Nossair, A.A. and Ewais, W.A. (2022) Combined Subconjunctival Atropine and Intracameral Epinephrine Injection for Pupil Dilation in Phacoemulsification under Peribulbar Anesthesia. *The Egyptian Journal of Hospital Medicine*, 89(2) 7482–7488.
- Sarkar, S., Kasturi, N. and Bardoloi, N. (2021) Minimizing Topical Medication in Cataract Surgery. *TNOA Journal of Ophthalmic Science and Research*, 59(4) 338–343.
- Schwarzenbacher, L., Schartmüller, D., Leydolt, C. and Menapace, R. (2022) Prostaglandin release after low-energy femtosecond laser-assisted cataract surgery without anti-inflammatory drug premedication. *American Journal of Ophthalmology*, 238 103–109.
- Shahbaz, M., Ali, S., Siddiq, S., Mustafa, A., Ihsan, K.M. and Azhar, F. (2020) Efficacy of nepafenac in maintaining mydriasis during phacoemulsification surgery. *Rawal Medical Journal*, 45(4).
- Sharon, T., Hecht, I., Atar Vardi, M., Eremenko, R., Assia, E.I., Pras, E. and Safir, M. (2022) Preoperative atropine and non-steroidal anti-inflammatory drugs for the prevention of intraoperative floppy iris syndrome. *Graefe's Archive for Clinical and Experimental Ophthalmology*, 260(3) 893–900.
- Shrivastava, A.K., Nayak, S. and Anto, M. (2021) Efficacy of Nepafenac versus Flurbiprofen in Maintaining Intraoperative Mydriasis During Phacoemulsification: A Comparative Study. *Clinical Ophthalmology*, 1085–1093.
- Stewart, S., Liu, Y.-C., Setiawan, M., Lin, M.T.-Y., Lee, I.X.Y., Sim, N., Htoon, H.M., Ong, H.S. and Mehta, J.S. (2022) The Effects of High Energy Capsulotomy on Aqueous Cytokine Profiles and Pupil Size During Femtosecond Laser-Assisted Cataract Surgery. *Journal of Refractive Surgery*, 38(9) 587–594.
- Uddin, S. and Rashid, H. (2022) A Comparison of Topical Nepafenac with Ketorolac Tromethamine in Maintaining Pupillary Dilatation during Phacoemulsification. *Journal of Saidu Medical College Swat*, 12(1) 11–15.
- Way, C., Swampillai, A.J., Lim, K.S. and Nanavaty, M.A. (2023) Factors influencing aqueous flare after cataract surgery and its evaluation with laser flare photometry. *Therapeutic Advances in Ophthalmology*, 15 25158414231204110.
- Ziemba, P., Janocha, A., Jerzak, A. and Jakubowska, K. (2024) Dangers in the use of systemic and local drugs expressed in eye disorders—a literature review. *Quality in Sport*, 18 53337.