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# Al-Shifa Journal of Ophthalmology

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# Al-Shifa Journal of Ophthalmology

A Journal of  
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**Aims and Scope:** ASJO, The official journal of Al-Shifa Trust Eye Hospital, Rawalpindi, publishes original reports of research in Ophthalmology mostly in the form of clinical studies. Topics may include new diagnostic and surgical techniques, treatment methods, atypical case reports, major and mini-reviews, preventive ophthalmology including health economics and applied research findings.

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In this study, the diagnostic accuracy of optical coherence tomography (OCT) was compared with fundus fluorescein angiography (FFA) in the early detection of choroidal neovascularization in Age Related Macular Degeneration. A total of 275 patients were enrolled and a pair of FFA and OCT images from the same visit was taken from each selected patient and was assessed by same observer. Diagnostic accuracy of OCT vs FFA, taking FFA as gold standard was calculated.

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## Smoke in the Operating Room

Tayyab Afghani

Mr. President! You wouldn't want your surgeons to sit in the Operating Room (OR) and smoke a pack-and-a-half of cigarettes while operating on their patients, but many are doing nearly the equivalent by creating surgical smoke and refusing to evacuate it. In an ophthalmology set-up, right on the top of the list of "surgical smokers" are from department of orbit and oculoplastics followed by vitreo retina folks.

After years of inhaling surgical plume, orthopedic surgeon Anthony Hedley, MD, FACS, of the Hedley Orthopaedic Institute in Phoenix, Ariz., was diagnosed with idiopathic pulmonary fibrosis and underwent a life-saving double lung transplant<sup>1</sup>.

Surgical smoke, a grossly neglected health hazards is facing operating room staff today. Surgical smoke includes roughly 150 chemicals, including 16 EPA priority pollutants, toxic and carcinogenic substances, viruses and bacteria<sup>1</sup>. It will be of some interest to know that sevoflurane, a common anesthetic given during the operation, has been found in surgical smoke and has been reported to cause numerous adverse effects. Similarly, it is suspected that type of the target tissues being cauterized like dermis, fat or muscle also influences smoke composition and its toxicity.

It is widely accepted that inhalation of smoke, specifically, the particulate matter (PM) found within smoke, can cause adverse effects on health. When diathermy devices, such as electrocauterization instruments, lasers, and ultrasonic scalpels, are used during surgery, surgical smoke, also called cautery smoke, surgical plume, laser plume, and diathermy plume, is released into the operating room. Although

smoke evacuation devices exist, they are not often used in practice owing to inconvenience and lack of awareness. Most operating room staff acknowledge adverse symptoms (e.g., coughing, headache) from surgical smoke, yet few wear effective personal protection<sup>2</sup>.

Inhalation of PM can cause adverse consequences to the respiratory, circulatory, and nervous systems. The lungs can become irritated, and the smaller particles can be absorbed into the bloodstream. Studies have suggested a link between exposure to PM and systemic inflammation and hypertension<sup>3</sup>. Many studies have shown a link between surgical smoke and the development of potentially fatal cardiovascular diseases<sup>4</sup>. Studies have reported links between exposure to PM and increased risk of neurologic and psychiatric disorders as well as adverse birth outcomes, such as low birth weight and risk of stillbirth<sup>3</sup>. Although the potential to spread disease through surgical smoke exists in theory, only human papillomavirus transmission has been seen<sup>5</sup>. Studies have determined that the cancer risk from exposure to surgical smoke is greater than negligible. One study determined that the 70-year lifetime cancer risk from exposure to polycyclic aromatic compounds from smoke for the surgeon is 117 times greater than for someone exposed to safe levels<sup>6</sup>.

The sizes of the particles in surgical smoke are reported as 0.07 to 0.42  $\mu\text{m}$  for electrocautery, 0.1 to 0.8  $\mu\text{m}$  for laser ablation, and 0.35 to 6.5  $\mu\text{m}$  for ultrasonic scalpels<sup>7,8</sup>. Studies have shown that most PM from electrocautery and lasers can be as small as 10 nm, and a large proportion is between 100 nm and 1  $\mu\text{m}$ . This small size

poses a problem in that some ultrafine particles within surgical smoke may be able to penetrate high-performing filters and masks.

The temperature of the plumes also matters. Low temperature laser plume has been found to contain several potentially infectious components, such as viable bacteriophages, viable cells, and virus particles, and is believed to have a higher infectious potential than high temperature electrocautery smoke<sup>9</sup>. Therefore, electrocautery smoke is believed to have a smaller potential for disease transmission than other forms.

Personal protection against surgical plumes by OR staff is almost non-existent. Surgical masks are used widely, but these do not protect against surgical smoke which requires special filtration masks (Medical Mask/N95 Filtering Facepiece Respirators). Procedures used for the elimination of smoke from the operating room vary widely. Like us in Al-Shifa a large number of surgeons use dispersion for smoke clearance. A suction device is held close to the generated smoke and the smoke is then suctioned into a large canister on the other side of the room. It is recommended that the suction device be kept within 5 cm of the surgical site and have a capture velocity of 31 to 46 m per minute to ensure efficient removal of PM<sup>10</sup>. The other form of smoke elimination system for the operating room is the smoke evacuator either attached to the conventional suction devices or directly built into electrocautery instruments. Commonly used filters are high-efficiency particulate air (HEPA) filters, and ultra-low particulate air (ULPA) filters or a combination of both. However, these filters must be regularly replaced to maintain efficiency because particles can assemble and later be broken down and released into the environment. Furthermore, microorganisms can potentially grow from deposited organic

compounds, especially with the influence of moisture<sup>11</sup>.

In brief, surgical smoke contains numerous toxic, mutagenic, and carcinogenic compounds, sometimes exceeding recommended limits set by national and international health organizations. It is widely recommended to use a smoke evacuation device to purify the smoke and capture particulate matter. However practical difficulties, like noise, distraction, and limited space, along with a lack of knowledge on the hazards of surgical smoke, are important barriers for many surgeons to use these devices. Also, the smaller size of surgical smoke particulate matter and ultrafine particles make filtration difficult. Despite that, since there is no safe level of surgical smoke, evacuation of PM during surgery is recommended. Ophthalmic professional staff working in oculoplastics and vitreoretinal surgical services should preferably use special filtration masks.

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# Influence of Energy levels of Neodymium-Doped Yttrium Aluminium Garnet Laser on Macula after Posterior Capsulotomy

Yawar Iqbal<sup>1</sup>, Adnan Aslam Saleem<sup>2</sup>, Anique Ahmad<sup>3</sup>, Sajida Parveen Shaikh<sup>4</sup>, Sarah Zafar<sup>4</sup>

## Abstract

**Objectives:** To determine the frequency of increase in central macular thickness (CMT) and compare mean CMT after low and high energy levels of YAG laser after posterior capsulotomy.

**Subjects and Methods:** This descriptive case series was done in Armed Force Institute of Ophthalmology, Pakistan from May 2013 to February 2014. One hundred-seventy eyes were enrolled and base line CMT was measured with SD-OCT. Following pupil dilatation YAG laser posterior capsulotomy was completed and cumulative energy noted. Patients were classified according to cumulative energy used ( $\leq 80$  mJ = low energy,  $\geq 80$  mJ = high energy). CMT was measured one-month post-laser.

**Results:** Raised CMT was noted in 58 (34.1 %) cases. Mean pre-laser CMT in the low energy group was  $215.11 \pm 6.72$   $\mu\text{m}$  whereas, in high energy group mean pre-laser CMT was  $215.42 \pm 6.79$   $\mu\text{m}$ . Mean post-laser CMT in low energy group was  $215.80 \pm 8.32$   $\mu\text{m}$ . Mean post-laser CMT in the high energy group was  $219.51 \pm 10.11$ . Both groups had increased macular thickness compared to pre-laser levels but the frequency of raised CMT was more in the high energy group,  $P \leq 0.05$ .

**Conclusion:** Increased macular thickness is expected after YAG capsulotomy, but the severity and frequency is less when a total energy level of less than 80 mJ is used. OCT is an indispensable diagnostic tool for monitoring patients undergoing YAG capsulotomy. *Al-Shifa Journal of Ophthalmology* 2018; 14(4): 169-175. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

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## Introduction:

Posterior capsule opacification (PCO) is a common delayed post-operative complication after modern day cataract surgery, with reported frequencies ranging from 8.7-33.4% after 5 years.<sup>1,2</sup> PCO usually develops due to the lens epithelial cells (LEC) being left behind in the capsular bag. Studies suggest that the posterior capsule (PC) itself does not opacify; opacification occurs due to the formation of secondary membranes by proliferation, migration, epithelial-to-mesenchymal transition, collagen deposition and lens fiber regeneration of the LEC.<sup>3</sup>

The treatment of choice for treating PCO is Neodymium Doped Yttrium-Aluminum-Garnet (Nd:YAG) laser posterior capsulotomy. Although the procedure is safe, closed-eye and effective; complications such as refractive shift, retinal detachment, raised intraocular pressure (IOP), uveitis, cystoid macular edema (CME) and endophthalmitis have been reported. The laser potentially damages the blood-aqueous and blood-retinal barrier resulting in release of inflammatory mediators such as prostaglandins and leukotrienes which induce anterior segment and macular changes.<sup>4</sup> Optical coherence tomography (OCT) is an objective and quantifiable method of assessing macular thickness with excellent reproducibility.<sup>5</sup>

Macular edema following YAG capsulotomy is a recognized complication but few attempts have been done to find the relation between the amount of energy used and the frequency of macular edema. We undertook this study to identify the safe cumulative energy levels that might be used during Nd:YAG posterior capsulotomy, incurring minimal macular edema.

### **Subjects and Methods:**

Written informed consent was obtained from all patients based on Helsinki protocol. The hospital ethics committee and institutional review boards approved the trial. The study was performed over 8 months and included patients with PCO detected on slit lamp biomicroscopy. Inclusion criteria included PCO developing 6 months after uneventful phacoemulsification for senile cataracts in patients aged  $\geq 50$  years irrespective of gender. The patients were chosen for treatment if they had PCO with reduced visual acuity (VA), glare or monocular diplopia.

All lasers were performed on eyes implanted with foldable hydrophobic or hydrophilic acrylic IOLs. Patients with

corneal opacities, history of retinal detachment (RD) in the fellow eye, peripheral retinal degenerations, retinal breaks, history of vitreo-retinal surgery, glaucoma, diabetic retinopathy and age-related macular degeneration were excluded. If signal strength of OCT (Q-Factor) was below 50, the patients were excluded.

Patients fulfilling inclusion criteria were selected by non-probability consecutive sampling. After informed consent patients were subjected to comprehensive ophthalmic examination including dilated slit lamp biomicroscopy followed by baseline central macular thickness (CMT) measurement with an OCT. Thickness of central 1 mm retinal area was measured by a high-resolution spectral domain OCT/SD-OCT system (*Topcon Mark 2-1000*). A second reading was taken one month post-laser to document any change in macular thickness.

A Q-switched Nd:YAG laser system (*Visulas YAG III, Carl Zeiss, Germany*), with wavelength of 1064 nm and pulse duration of  $< 4$  nanoseconds (ns) was employed. Laser capsulotomy was performed using an Abraham lens with methylcellulose as a coupling agent. One drop of 0.5% proparacaine was instilled into the conjunctival cul-de sac before the procedure. The pupils were maximally dilated, and the aim was to create a central capsulotomy of about 4 mm in size. A cruciate pattern in an upward to downward direction was used. The aiming beam was focused just posterior to the PC. The optical center of the IOL was matched with the center of the opening. The starting initial energy level was 0.5-10 millijoules (mJ); cumulative laser energy was noted in each case.

According to the cumulative energy, the patients were divided in two groups i.e. low and high energies. High energy group (cumulative energy of  $\geq 80$  mJ was used),

low energy group (cumulative energy used was  $\leq 80$  mJ). The post-laser regimen included topical 0.1% dexamethasone, every four hours, tapered over 3 weeks. No patients were given antiglaucoma medications prior to capsulotomy. Statistical analyses were performed with SPSS software (version 17, SPSS Inc. Chicago, IL). Independent sample t-test and Chi square test was applied where appropriate. P value  $\leq 0.05$  was taken as significant.

### Results:

Out of 170 cases, 12.9 % patients were aged 50-59, 40.6% were aged 60-69 years, 40.6% were aged 70-79 years and 5.9 % were aged more than 80 years. Mean age in high energy group was  $67.94 \pm 8.37$  years and in low energy group was  $68.94 \pm 7.30$  (Table 1). There were 57.1% males and 42.9% females in total. Both groups were comparable with respect to gender ( $P= 0.278$ ).

Mean pre-laser CMT in the low energy group was  $215.11 \pm 6.72$   $\mu\text{m}$  (min - 202  $\mu\text{m}$ , max - 230  $\mu\text{m}$ ) whereas in high energy group mean pre-laser CMT was  $215.42 \pm 6.79$   $\mu\text{m}$  (min - 201 $\mu\text{m}$ , max - 235  $\mu\text{m}$  ). Mean post-laser CMT in low energy group was  $215.80 \pm 8.32$   $\mu\text{m}$  (min - 202  $\mu\text{m}$ , max - 245  $\mu\text{m}$ ). Mean post-laser CMT in high energy group was  $219.51 \pm 10.11$  (min - 201 $\mu\text{m}$  and max - 249  $\mu\text{m}$ ).

Out of total 170 patients raised CMT was noted in 58 (34.1 %) cases and CMT didn't increase in 112 (65.9 %) cases. In low energy group, raised CMT was noted in 14 out of 85 (8.2 %) cases, as compared to 71 (83.5 %) cases in which CMT remained normal. In high energy group, raised CMT was noted in 44 out of 85 (51.8 %) cases as compared to 41 (48.2 %) cases in which CMT remained normal. A significant high frequency of raised CMT was found after high energy Nd:YAG laser posterior capsulotomy, p value  $\leq 0.05$  [Table:2] .

**Table 1: Descriptive Statistics in Groups of the patients**

Age (Yrs)		n	Mean	Median	SD	IQR
	low energy	85	68.94	69.00	7.30	12.50
	high energy	85	67.94	67.00	8.37	15.00
<b>CMT (<math>\mu\text{m}</math>) baseline</b>	low energy	85	215.11	214.00	6.72	9
	high energy	85	215.42	215.00	6.79	8
<b>CMT (<math>\mu\text{m}</math>) post-laser</b>	low energy	85	215.80	214.00	8.31	9
	high energy	85	219.50	217.00	10.11	13

**Table 2: Comparison of Increase in CMT ( $\mu\text{m}$ ) in Energy Group**

\*Statistically significant (p-value< 0.05)

Increase in CMT ( $\mu\text{m}$ )	Group of the patient		Total	P-value
	Low energy	High Energy		
<b>Yes</b>	14	44	58	0.001 *
	8.2%	25.9%	34.1%	
<b>No</b>	71	41	112	
	41.8%	24.1%	65.9%	
<b>Total</b>	<b>85</b>	<b>85</b>	<b>170</b>	

## Discussion:

PCO profoundly affect the patient's quality of life due to poor VA and increased glare. Nd:YAG is a solid-state laser with photo-disruptive properties. YAG capsulotomy involves focusing a laser pulse, with energy of several mJ within duration of several nanoseconds. ring.<sup>6,3,18</sup>

Increased macular thickness is a significant complication after YAG capsulotomy. Even subtle macular thickening diminish the quality of vision inducing subtle contrast sensitivity deficits, color deficits and reading speed deficits. Studies report that side effects are more pronounced when higher single-pulse energy rather than higher total-pulse energy is used.<sup>7,6,16</sup> In this case series when energy levels of less than 80 mJ were used, it resulted in insignificant macular changes ( $p \leq 0.05$ ). This endorses, that lowest total energy should be used to clear the PCO.

Most studies have reported rates of CME after YAG of around 0.8% to 2.5%.<sup>8,9,13,15</sup> However some studies suggest that there are no changes in CMT following YAG capsulotomy. *Giocanti* analyzed thirty eyes; the mean foveal thickness pre-laser was  $209 \pm 26 \mu\text{m}$ ,  $204 \pm 19 \mu\text{m}$  at 1 month and  $213 \pm 23 \mu\text{m}$  at 3 months post-laser. The foveal thickness did not significantly change during the first 3 months following laser.<sup>10,11</sup> In a prospective study on 31 pseudophakic eyes with PCO and using the other eye as a control, the authors didn't find any negative effect on the macula or the endothelium during at 3-month follow-up.<sup>12</sup> This is in contrast to our findings where we found an increase in CMT post-laser at 4 weeks in 34.1 % of the cases. However, in the remainder of cases insignificant change in CMT occurred. In an older series involving 897 YAG capsulotomies only 11 patients (1.23%; 95% CI) developed CME which occurred many months after capsulotomy and many months-years after the cataract surgery. Furthermore, they stated that the numbers of laser pulses

and energy delivered were not risk factors in the development of CME.<sup>13</sup> In another series involving 54 eyes the foveal thickness did not significantly change in the first year after laser treatment. CME developed in only 1 patient (2%). Patient age, gender, time between surgery & laser capsulotomy, total laser shots, total laser energy or mean laser energy per shot did not affect the foveal thickness.<sup>14</sup> Increase in CMT should be anticipated in case involving a higher cumulative energy expenditure of  $> 80 \text{ mJ}$  and managed accordingly.

Transient rise in CMT after Nd:YAG laser capsulotomy has been reported and documented in literature. A study on 104 eyes in Karachi found an incidence rate of CME of 9.6% after YAG capsulotomy, which is markedly higher when compared to incidence rates worldwide and to the above mentioned studies. They suggested that probably these patients had ongoing postoperative CME in addition to the PCO and the application of the YAG laser could have exacerbated the pre-existing CME. Furthermore, the study diagnosed CME on slit lamp exam, not on OCT or FFA hence there is a possibility they could have overlooked sub-clinical CME.<sup>15</sup>

Even though various studies suggest there is negligible effect on the macula in terms of time between surgery & laser capsulotomy, conversely a good number of studies propose that the time interval between cataract surgery and YAG laser posterior capsulotomy is inversely proportional to the incidence of macular edema.<sup>17,7,13,15</sup> Release of inflammatory mediators rise and macular edema worsens, especially when posterior capsulotomy is applied 8 to 12 weeks after cataract surgery.<sup>18</sup> In the current study, the interval between cataract surgery and capsulotomy was at least 24 weeks. Furthermore, we ruled out subclinical CME by doing a pre-laser OCT. Although there was a significant increase in macular thickness at one month following

the procedure, especially in the high energy, it resolved without any medical treatment during follow-up.

YAG laser capsulotomy can affect the posterior eye segment in number of ways. A study analyzed the influence of total laser energy on the frequency of the complications during a six-month period. The diagnosed rupture of the anterior hyaloid face in 7.5% of the cases, retinal tear in 4.1%, macular tear in 2.5%, retinal detachment in 2.5%, CME in 4.1%, macular scarring in 10.8% and changes in the vitreous body in 10.8% of the eyes. The influence total laser energy on the complications was statistically significant with a strong correlation.<sup>20</sup>

A study evaluated anterior hyaloid damage (AHD) related YAG laser parameters and retinal complications in subjects that underwent YAG laser capsulotomy. AHD was observed in 49 eyes (19.2 % of 255 eyes). The pulse number, pulse energy and total energy were observed to be higher in eyes with AHD ( $P < 0.001$ ). CME was detected in five eyes (three with AHD) at 1-week. Occurrence of retinal complication in the AHD group was 12.7 times higher than the group with no AHD, adjusted for total energy used ( $P < 0.001$ ). Anterior hyaloid face integrity should be considered for YAG laser-related retinal complications particularly CME.<sup>21</sup>

A study was done to find the correlation between eye aperture diameter and occurrence of complications in the posterior eye segment after Nd-YAG capsulotomy on 120 eyes with PCO. Six months after YAG capsulotomy they found CME in 2 (1.66%) eyes. They concluded that the aperture size in PC directly correlates with the number of complications and suggested that the aperture diameter should not exceed 4.0 mm.<sup>22</sup> In all our cases we made a capsulotomy size of around 4 mm in the PC

in a cruciate manner centered on the optical axis.

In comparison to the other studies mentioned our study showed a very high frequency of increase in CMT as seen in 58 cases (34.1 %) out of 170 cases, which is significantly higher for the high energy group amounting to 44 cases (25.9 %). If we assess clinically the actual mean increase in CMT wasn't considerable but this increase was statistically significant especially in the high energy group. This illustrates the sensitivity, specificity and reproducibility of high-resolution OCT in evaluating macular parameters. An additional possible factor is the late presentation of patients in our population. Patients present when a thick PCO markedly reduced VA. This is largely due to lack of awareness, socioeconomic grounds and deficient tertiary eye health care facilities. A thick PCO requires higher total laser shots, total energy and energy per shot. In these cases, technique and expertise are important in reducing the laser energy required for the procedure.

### **Conclusion:**

It is concluded that frequency of raised CMT is directly related to the amount of energy used. It is therefore recommended that patients undergoing YAG laser capsulotomy should receive minimum amount of energy and patient should be followed-up to detect changes in CMT.

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## Comparison Between the Efficacy of Intracameral Injection Dexamethasone and Subconjunctival Injection Dexamethasone in Preventing Post-Operative Inflammation After Phacoemulsification

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### ABSTRACT:

**Objective:** To compare the efficacy of Intracameral injection of dexamethasone and subconjunctival injection of dexamethasone in preventing post-operative inflammation after phacoemulsification.

**Study Design:** Randomized controlled trial.

**Place and duration of study:** Department of Ophthalmology, Sheikh Zayed Medical College and Hospital, Rahim Yar Khan from 16<sup>th</sup> January 2016 to 15<sup>th</sup> July 2016.

**Subjects and Methods:** A total of 74 patients, 50-70 years of age with senile cataract were included in this study. Patients with anterior uveitis, any ocular pathology, previous ocular surgery and co-morbid conditions were excluded. Then selected patients were randomly assigned into two groups i.e. Group-A (subconjunctival dexamethasone) and Group-B (intracameral dexamethasone). Outcome variables like efficacy i.e prevention of post-operative inflammation, were noted.

**Results:** The mean age of patients in group-A was  $62.71 \pm 4.97$  years and in group-B was  $62.52 \pm 5.06$  years. Out of 74 patients, 49 (66.22%) were males and 25 (33.78%) were females with male to female ratio of 1.96:1. Efficacy of subconjunctival dexamethasone group was 16 (43.24%) while intracameral dexamethasone group was 26 (70.27%) with p-value of 0.019 which is statistically significant.

**Conclusion:** This study concluded that Intracameral injection of dexamethasone is better and more efficacious than subconjunctival injection of dexamethasone in preventing post-operative inflammation after phacoemulsification. *Al-Shifa Journal of Ophthalmology 2018; 14(4): 176-182.* © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

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### Introduction:

A cataract is a clouding of the lens inside the eye which leads to a decrease in vision. It is the most common cause of blindness and is conventionally treated with surgery. Visual loss occurs because of opacification of the lens which obstructs light from passing and being focused on to the retina at the back of the eye<sup>1</sup>. Cataract is the world's leading cause of avoidable blindness affecting an estimate of 20 million people and this figure is expected to increase to 50 million by the year 2020<sup>2</sup>. More than half of all persons over the age of 65 develop age-related cataract with

visual disability<sup>3</sup>. Globally, the number of cataract cases is expected to increase as population age and lifespan increases<sup>4</sup>. In Pakistan, 66% of the blindness is due to cataract<sup>5</sup>. Cataracts are the most common cause of vision loss in developed and developing countries<sup>6,7</sup>.

Complications from lack of treatment of cataract include sensitivity to glare, poor night vision and progressive vision loss.<sup>3</sup> Surgical removal of cataract remains the only treatment option for patients with failing vision.<sup>4</sup> Cataract surgery is one of the most frequently performed surgeries in the world.<sup>8</sup> Phacoemulsification is the most widely used cataract surgery today. This procedure uses ultrasonic energy (U/S) to emulsify the cataract lens. Phacoemulsification offers the advantage of using smaller incisions, minimizing complications arising from improper wound closure, and affording more rapid wound healing and faster visual rehabilitation. Furthermore, it uses a relatively closed system during both phacoemulsification and aspiration with better control of intraocular pressure during surgery, providing safeguards against positive vitreous pressure and choroidal hemorrhage. However, more sophisticated machines and instruments are required to perform phacoemulsification.<sup>9</sup>

Surgical manipulation during phacoemulsification leads to the disruption of the blood aqueous barrier, resulting in intraocular inflammation.<sup>10</sup> Clinically iritis is the hall mark of intraocular inflammation, characterized by perilimbal injection and anterior chamber cells and flare. Inflammation after intraocular surgery, if not controlled effectively, can prolong patient recovery, raise intraocular pressure, and increase the likelihood of cystoid macular edema, synechiae formation, posterior capsule opacification, and secondary glaucoma.<sup>11</sup> A study held in Pakistan by Ahmad CN et al<sup>5</sup> showed that the efficacy of intracamerally

dexamethasone in preventing post-operative inflammation in first 24 hours is 66.67% compared to subconjunctival route which has only 33.33%.

The purpose of this study was to see the effective route of dexamethasone injection between intracameral and subconjunctival in preventing post-operative inflammation after phacoemulsification in local population. Then based on these results, some practical recommendations could be made in our routine practice guidelines for preventing post-operative inflammation after phacoemulsification in order to reduce the morbidity.

### **Subjects and Methods:**

This randomized control trial was conducted for a period of six months from January 2016 to July 2016 in the department of ophthalmology Sheikh Zayed Medical College and Hospital, Rahim Yar Khan. The study was approved by the Ethical and Research Board of the Hospital. Seventy-four patients with age-related cataracts fulfilling the inclusion and exclusion criteria were recruited in the study. Inclusion criteria were adult patients with age-related cataracts aged between 50-70 years, of either gender presenting to eye out patient department. Exclusion criteria were patients with diabetes mellitus, hypertension and dyslipidemia; smokers; patients who take anti-inflammatory drugs for any systemic disease; patients having history of prior ocular surgery or trauma; patients having history of any ocular disease including glaucoma, age related macular degeneration, retinal vein occlusion and uveitis; patients with single functioning eye; patients not willing to be included in the study. The procedure was explained to the patients and only those who gave informed consent were recruited. All patients underwent a detailed ophthalmic examination including visual acuity assessment, slit lamp examination and dilated fundus examination pre-

operatively and twenty-four hours post-operatively.

Seventy-four cataract patients, fulfilling the inclusion and exclusion criteria, were admitted to the Department of Ophthalmology, Sheikh Zayed Hospital, Rahim Yar Khan. Informed consent was taken after explaining the aims, methods, reasonably anticipated benefits and potential hazards of the study. Subjects were informed that their participation is voluntary and that they may withdraw their consent at any time during the study. They were also informed that choosing not to participate will not affect their care.

After taking the informed consent from all selected seventy-four patients, for participation in the study, two groups of patients were made by lottery system. All selected cases were offered to pick up a slip from total mixed up slips (half-slips were containing letter 'A' and other half of the slips were containing letter 'B') and he/she was placed in that respective group. In this way two groups of patients, containing 37 patients each, were made. All patients were operated by the same eye surgeon, by phacoemulsification procedure with intraocular lens implantation. All the 37 patients of Group-A were given subconjunctival injection of dexamethasone 2mg in 0.5cc at the end of the procedure and the Group-B comprising of 37 patients were given dexamethasone 0.4mg in 0.1cc by intracameral route, at the end of the procedure. After the surgery, dexamethasone eye drops (one drop every two hours) and Tobramycin eye drops (one drop every six hours) were given to every patient of both groups for the period of two months with gradual tapering of dose of dexamethasone eye drops. All patients in both groups were evaluated after 24 hours post-operatively by the consultant for efficacy.

Efficacy was considered as 'yes' if there were inflammatory cells (T lymphocytes

and polymorphonuclear neutrophils) <15cells/field in anterior chamber, absent aqueous flare (foggy appearance given by protein that has leaked from inflamed blood vessels) and absent posterior synechiae (adhesions between iris and lens) on slit lamp examination.

Efficacy was considered as 'no' if there were presence of any one of the followings; inflammatory cells (T lymphocytes and polymorphonuclear neutrophils) >15cells/field in anterior chamber, aqueous flare (foggy appearance given by protein that has leaked from inflamed blood vessels) and posterior synechiae (adhesions between iris and lens) on slit lamp examination.

All this data was recorded on a predesigned proforma which contained two parts i.e part-1 contained the patient's bio-data while part-2 contained the study variables. The data was entered and analyzed by Statistical Package for Social Sciences (SPSS) version 16. Mean and Standard Deviations were calculated for age. Frequencies and percentages were calculated for qualitative variables like gender and efficacy (yes/no). Comparison between the groups with respect to efficacy was analyzed by Chi-square test. P value  $\leq 0.05$  was considered as significant. Effect modifiers like age and gender were controlled through stratification and post-stratification Chi-square test was applied to see the effect of these on outcome variables and p-value  $\leq 0.05$  was taken as significant.

### **Results:**

Age range in this study was from 50-70 years with mean age of  $62.68 \pm 5.01$  years. The mean age of patients in group-A was  $62.71 \pm 4.97$  years and in group-B was  $62.52 \pm 5.06$  years. Majority of the patients 39 (52.70%) were between 61 to 70 years of age. Out of 74 patients, 49 (66.22%) were males and 25 (33.78%) were females.

Efficacy (no post-operative inflammation after 24 hours) of Group-A (subconjunctival dexamethasone group) was 16 (43.24%) while in Group-B (intracameral dexamethasone group) was 26 (70.27%) as shown in Table I (p-value = 0.019). Comparison between the efficacy of both groups according to age groups have been

shown in Table II, which showed significant difference of efficacy between both groups among 50-60 years of age. Table III has shown comparison between efficacy of both groups according to gender and significant difference was found among male patients but no significant difference among female patients.

**Table I: %age of patients according to Efficacy in both Groups.**

Efficacy	Group A (n=37)		Group B (n=37)		P-value
	No. of Patients	%age	No. of Patients	%age	
<b>Yes</b>	16	43.24	26	70.27	<b>0.019*</b>
<b>No</b>	21	56.76	11	29.73	

\*Statistically significant.

**Table II: Comparison between Efficacies of both groups according to age.**

Age of patients (years)	Group A (n=37)		Group B (n=37)		P-value
	Efficacy		Efficacy		
	yes	no	Yes	No	
<b>50-60</b>	07 (41.18%)	10 (58.82%)	14 (77.78%)	04 (22.22%)	<b>p-value &lt;0.05*</b>
<b>61-70</b>	09 (45.0%)	11 (55.0%)	12 (63.16%)	07 (36.84%)	p-value > 0.05

\*Statistically significant.

**Table III: Comparison between Efficacies of both groups according to Gender.**

Gender	Group A (n=37)		Group B (n=37)		P-value
	Efficacy		Efficacy		
	yes	no	Yes	No	
<b>Male</b>	13 (54.17%)	11 (45.83%)	06 (24.0%)	19 (76.0%)	<b>p-value &lt;0.05*</b>
<b>Female</b>	03 (23.08%)	10 (76.92%)	05 (41.67%)	07 (58.33%)	<b>p-value &gt;0.05</b>

\*Statistically significant

### Discussion:

Cataract removal can be performed at any stage and no longer requires ripening of the lens. Surgery is usually 'outpatient' and performed using local anesthesia. About 9 out of 10 patients can achieve a corrected vision of 20/40 or better after surgery. Several recent evaluations found that surgery can only meet expectations when there is significant functional impairment from poor vision prior to surgery.<sup>12-14</sup>

Phacoemulsification is a mechanically assisted extracapsular technique of cataract extraction surgery.<sup>15</sup> Phacoemulsification is the most widely used cataract surgery today. This procedure uses ultrasonic energy (U/S) to emulsify the cataract lens and aspirated from the eye. Aspirated fluids are replaced with irrigation of balanced salt solution, thus maintaining the anterior

chamber, as well as cooling the handpiece.<sup>16-21</sup>

In our study, efficacy (no post-operative inflammation after 24 hours) of subconjunctival dexamethasone group was 43.24% while in intracameral dexamethasone group was 70.27% which was statistically significant with p-value of 0.019. Karalezli A et al<sup>22</sup> reported effective suppression of post-operative inflammation with intracameral dexamethasone injection after cataract surgery. He concluded that intracameral steroid injected intracamerally had anti-inflammatory properties equivalent to prednisolone eye drops after cataract surgery and may help patients with compliance and the use of postoperative eye drops and may also prevent the side effects of corneal melts, conjunctival irritation and dry eye that occur with frequent use of multiple numbers of topical eye drops.

Intracameral and intravitreal injections of triamcinolone given at the end of phacoemulsification, in conjunction with standard postoperative corticosteroid eye drops, have proven to be beneficial in uveitic eyes.<sup>23-25</sup> Gills JP et al<sup>26</sup> were able to replace postoperative steroid drops with increasing concentrations of intracameral steroid injected after cataract surgery. Chang DTW et al<sup>27</sup> in a study had found that intracameral dexamethasone given at the end of cataract surgery significantly reduces postoperative inflammation in eyes with and without glaucoma. On the other hand, Oh JY et al<sup>28</sup> applied steroid intracamerally into rabbit eyes to investigate the effect of it on the corneal endothelium. He had found no statistically significant differences in endothelial cell counts and central corneal thickness following intracameral injection of steroid compared with controls.

A study held in Pakistan by Ahmad CN et al<sup>5</sup> showed that the efficacy of intracamerally dexamethasone in preventing post-operative inflammation in

first 24 hours is 66.67% compared to subconjunctival route which has only 33.33%. In the same study, it was shown that Intracameral dexamethasone itself was not associated with any complication. Although no study is available internationally which compares intracameral injection of dexamethasone with subconjunctival dexamethasone however intracameral route has been found significantly effective in many studies.<sup>23-26</sup>

Intracameral injection of dexamethasone proved to be an equally effective alternative to subconjunctival injection of dexamethasone preoperatively by Hasnain M et al.<sup>29</sup> The findings of this study after 24 hours had shown cells in anterior chamber  $\leq +2$  in 57% patients, cells in anterior chamber  $\geq +3$  in 36% patients and membrane in anterior chamber in 63% patients who were given subconjunctival dexamethasone injection while in intracameral dexamethasone injection group, it was found in 47%, 43% and 70% patients respectively. He has also shown that subconjunctival injection can cause pain and subconjunctival haemorrhage that can be distressing to the patient.<sup>29</sup>

### **Conclusion:**

This study concluded that Intracameral injection of dexamethasone is better and more efficacious than subconjunctival injection of dexamethasone in preventing post-operative inflammation after phacoemulsification. So, we recommend that Intracameral injection of dexamethasone should be used routinely per-operatively in these patients instead of subconjunctival route in order to prevent post-operative inflammation after phacoemulsification which will ultimately reduce their morbidity.

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# A Clinic-Based Study of Patients with Strabismus in Pediatric Age Group

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## Abstract

**Objective:** This cross-sectional observational study to determine the distribution and pattern of strabismus in children seen at a tertiary care pediatric eye care unit.

**Materials and Methods:** The study was conducted in Al-Shifa Trust Eye hospital Rawalpindi, Pakistan from March 2013 to July 2014. During this period, a total of 711 children, aged 1-12 years were evaluated. All children underwent complete ophthalmic examination including cycloplegic refraction.

**Results:** Out of the 711 children, 47 % (334) were girls and 53 % (377) were boys. 56.1 % (399) children had esodeviations whereas 32.3% (230) had exodeviations. In esotropic children, constant esotropia accounted for 41.9 % cases, 14.2 % cases had infantile esotropia whereas 1.3 % had intermittent esotropia. The most common cause of constant esotropia was refractive accommodative esotropia. Non-accommodative (basic) esotropia was the second most common esodeviations. 145 (20.4 %) cases had constant exotropia and 85 (12 %) cases had intermittent exotropia. The basic type (50.6 %) was the most common presentation of intermittent exotropia. 41.1 % of the cases diagnosed with intermittent exotropia had convergence insufficiency. 7.7 % were diagnosed with pseudo-strabismus. Incomitant strabismus was less common in this population; causes included of 6<sup>th</sup> nerve palsy, Monocular Elevation Defect, Congenital Fibrosis of Extraocular Muscles and Duane Syndrome.

**Conclusion:** Constant esotropia, congenital esotropia and constant exotropia were the most common form of deviations noted in our pediatric population. It is vital to promote public education on the significance of early detection of strabismus. *Al-Shifa Journal of Ophthalmology 2018; 14(4): 183-190.* © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

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## Introduction:

An estimated 285 million people around the world are visually impaired; 19 million are children below the age of 14 years.<sup>1</sup> Childhood visual impairment is estimated to be the second leading cause of the burden due to blindness. Forty percent of childhood blindness is preventable; 12 million children are visually impaired merely because of refractive errors.<sup>2,3</sup> Uncorrected refractive errors lead to amblyopia and strabismus. Hence strabismus is a major cause of childhood visual impairment and amblyopia.

Visual impairment from strabismus has immediate and long-term effects on children, particularly on school life.



Children with strabismus suffer from various psychosocial and emotional problems such as low self-esteem, negative social prejudice, social anxiety, weak relations and job prospect issues.<sup>4</sup> Visual disabilities in children are also more intricate compared to adults thus preventing visual impairment in children in resource-poor countries is one of the key components of *VISION 2020 the Right to Sight*.

There is scant literature and epidemiological data on childhood strabismus in Pakistan. The purpose of this study was to estimate the frequency and pattern of different types of strabismus in children seen at a tertiary level eye care. This will highlight the magnitude of pediatric strabismus and help gather information necessary for the planning eye care services in our region. To our knowledge, this is the first study reporting distribution and pattern of strabismus in Pakistani children.

### **Subjects and Methods:**

Approval for the study was obtained from the Hospital Research & Ethics Committee, Pakistan Institute of Ophthalmology. Written consent was taken from at least one parent before examination. Children aged 1-12 years were included in the study.

The presence of strabismus was ascertained in a standardized manner by experienced orthoptists who performed a Hirschberg test, followed by the cover-uncover test to detect manifest strabismus. If no strabismus was elicited, the alternating cover test to detect heterophoria was performed. Measurement of the size of any deviation used the prism bar cover test. The prism strength in diopters (D) that neutralized any movement of the eyes was recorded as the size of the deviation. This cover test sequence was carried out on all children at near (33 cm) and distance (6 m) fixation, with and without spectacles, if worn.

A Canon autorefractor (model RK-F1, Canon, Japan) was used to perform

cycloplegic autorefraction and keratometry. Cycloplegia was obtained after 3 cycles of cyclopentolate 1% (1 drop). Children also had a comprehensive eye examination assessment of ocular movements, slit-lamp examination and funduscopy. Type of strabismus was diagnosed by pediatric ophthalmologist as per standard definitions.

Statistical analyses were performed with SPSS software (version 17, SPSS Inc. Chicago, IL). Data primarily comprised qualitative variables hence presented as frequency and percentages. Quantitative data is presented as mean  $\pm$  SD. Data is presented in the form of tables and charts.

### **Results:**

711 children were included in the study. 47 % (334) were girls and 53 % (377) were boys. Esodeviations was more common; 56.1 % (399) children had esodeviations whereas 32.3% (230) had exodeviations. Children who had esodeviations; 215 were boys and 184 were girls. 142 boys and 88 girls had exodeviations. 2.3 % children had incomitant strabismus.

In esotropic children the most common diagnosis was constant esotropia with 41.9 % cases. 14.2 % cases had congenital/infantile esotropia whereas 1.3 % had intermittent esotropia. The most cause of constant esotropia was refractive accommodative esotropia (57.4 % cases of constant esotropia). Non-accommodative (basic) esotropia was the second most common esodeviations (36 % of the constant esotropes). Constant esotropia most commonly presented between 4-6 years of age with a median age of 5 years. Vertical deviations were commonly seen with esodeviations (5 cases). Only one isolated vertical deviation was seen out of the 711 cases.

We diagnosed 145 (20.4 %) cases of constant exotropia and 85 (12 %) cases of intermittent exotropia. The basic type (50.6

%) was the most common presentation of intermittent exotropia. 41.1 % of the cases diagnosed with intermittent exotropia had convergence insufficiency. Intermittent exotropia presented 21.6 % between 7-9 years and 15.6 % between 10-12 years of age with a median age of 5 years. Constant exotropia presented uniformly in different age groups with a median age of 4 years.

7.7 % were diagnosed with pseudo-strabismus. The most common form was

pseudoesotropia (78 %). Most commonly this was seen in children who have a wide nasal bridge with prominent epicanthal folds. Duane syndrome and mono-ocular elevation deficit (MED) were common causes of incomitant strabismus. 4 cases had congenital fibrosis of the extra-ocular muscles (CFEOM). We also diagnosed an uncommon case of bilateral Duane syndrome.

**Table 1: Proportion of Strabismus by Type**

Category	n (%)
Esotropia	
Constant Esotropia	298 (41.9)
Refractive accommodative	171 (24.1)
Non-refractive accommodative	11 (1.5)
Non-accommodative (basic)	107 (15)
Intermittent Esotropia	9 (1.3)
Congenital esotropia	101 (14.2)
Exotropia	
Constant	145 (20.4)
Intermittent	85 (12)
Basic	43 (6.0)
Convergence insufficiency	35 (4.9)
Divergence excess	7 (0.9)
Vertical deviations	9 (1.3)
In isolation	
In combination with esotropia	1 (0.1)
In combination with exotropia	5 (0.7)
	3 (0.4)
Incomitant strabismus	
6 <sup>th</sup> cranial nerve palsy	2 (0.3)
CFEOM	4 (0.6)
Duane Syndrome	5 (0.7)
Bilateral Duane Syndrome	1 (0.1)
MED	6 (0.8)
Pseudo-Strabismus	55 (7.7)

## Discussion:

Strabismus is a common ocular disorder that develops early in life. It is a pathological state associated with abnormal binocular single vision (BSV); characterized by misalignment of the visual axes, preventing an individual from directing both eyes simultaneously towards the same fixation point.<sup>5</sup> Normal BSV is required for occupational and vocational tasks, as well as numerous daily life activities. Strabismus in early life is detrimental to stereopsis; therefore, early intervention can go a long way in restoring it.<sup>6</sup>

Although BSV develops at the age of 2 years, the fixation reflex isn't fully established until the age of 9 years. Visual acuity remains in a state of flux prior to this age predisposing the child to anisometropia, strabismus and amblyopia. In a population-based study on 961 children with amblyopia the author found the cause to be strabismus in 57%, anisometropia in 17% and combination of two in 27% patients.<sup>7</sup> In a hospital-based study in the northern Pakistan the authors found strabismic amblyopia as the most common cause of amblyopia in children aged 4-14 years. Amblyopia was more common in males and in esotropes.<sup>8</sup>

The estimated prevalence of strabismus in the general population is from 2-5%. Concomitant strabismus accounts for 95% of the cases of strabismus.<sup>9</sup> In our study concomitant strabismus accounted for 97.5 % of the cases in children aged 1-12 years. Several studies have reported that esotropia appears to occur approximately 3-5 times as often as exotropia in children.<sup>10</sup> However, there are geographical and ethnic variations. Estimates of the prevalence of strabismus range from 3-4% in Indian children, 9.9% in Chileans and 2.8% in Australian children.<sup>11,12</sup> A lower prevalence of strabismus among children of East Asian ethnicity has been reported in several studies.<sup>13</sup>

A retrospective, population-based cohort study on 627 new cases of childhood strabismus during the 10-year study found 60.1% with esotropia, 32.7% with exotropia and 6.7% with hypertropia. Accommodative esotropia, intermittent exotropia and acquired non-accommodative esotropia were the predominant forms of strabismus in this Western population.

Esotropia was most common form in the first six years of life; beyond this age exotropia predominates until the teenage years.<sup>14</sup> Contrary to this, our results revealed that constant esotropia, congenital esotropia and constant exotropia were the most common form of deviations noted in our pediatric population. 56.1 % of the children had esotropia and 32.3 % had exotropia. Only 1.3 % had hypertropia, that too either in association with an exotropia or an esotropia.

It is well known that there are marked differences in the prevalence of certain ocular disorders among various ethnic groups. Studies from Hong Kong, Japan and Singapore suggest that children presenting with horizontal comitant strabismus are 2.5 times more likely to be exotropic than esotropic. This is in direct contrast to figures quoted in the USA and Australia. Exotropia is more common in Asians and is less common among Western populations.<sup>15</sup> Yu et al also report similar results; in addition, he reported that the ratio of exotropia/esotropia in Hong Kong has increased dramatically over the past decade. They suggested that the declining rate of hyperopia in the Asian populations may have a role in this changing trend.<sup>16</sup>

In our study we found 1.7 times more esotropes than exotropes. This is again in contrast to studies on Asian population. This study was done on Pakistani/South-Asian pediatric population, probably being of a different genetic and ethnic pool compared to Japan, Hong Kong and

Singapore population, produced these results.

In our study population refractive accommodative esotropia was the most common presentation in children with esodeviations. A close linkage between accommodative esotropia and hypermetropia is established, it is also not unexpected that a higher percentage of Caucasian children would become esotropic, particularly since the majority of esotropic children have accommodative esotropia. Esotropia is probably higher in white than in Asian children because white children are more likely to be moderate or high hypermetropes.

In our study population refractive accommodative esotropia followed by non-accommodative esotropia was the most common presentation in children with esodeviations. The median age of presentation of accommodative esotropia was 6 yrs. Studies report that approximately 50 percent of all childhood esotropias are either fully or partially accommodative.<sup>17</sup> A study found accommodative esotropia as the commonest type of esotropia followed by congenital esotropia. The incidence varies with the age group with highest incidence of 1 to 2 % occurring between 5 and 7 years of age and declining thereafter.

Non-accommodative esotropia was the second most common form of childhood esotropia, accounting for approximately 10% of all strabismus.<sup>18,19</sup> Infantile esotropia accounts for approximately 8.1% of cases of esotropia, affecting 1 in every 100–500 infants.<sup>20</sup> In our study population 61 % of the constant esotropes had accommodative esotropia out of which 57.4 % were refractive accommodative esotropes. 35.9 % of the constant esotropes had non-accommodative esotropia. Congenital esotropia accounted for 25.3 % cases of esotropia. This makes it almost three times more common than reported in literature.

The elevated prevalence of infantile esotropia may in part may also be due its apparent preponderance in the OPD; the commonly associated disorders of amblyopia, inferior oblique dysfunction, dissociated vertical deviations, nystagmus, and consecutive deviations increasing the relative frequency of examinations and diagnosis compared with other forms of childhood esotropia. Furthermore, this is a clinical based study with a large sample pool of referred cases; these factors could possibly produce these results.

Intermittent exotropia is the most common type of exotropia, affecting nearly 1% of the population.<sup>21</sup> The prevalence of exotropia is believed to be underestimated, because it is most often an intermittent deviation. Exotropia has been reported to be more prevalent among Asian and African American populations compared to Caucasians. We found that constant exotropia was more common than intermittent exotropia.

We diagnosed 145 (20.4 %) cases of constant exotropia and 85 (12 %) cases of intermittent exotropia. The basic type (50.6 %) was the most common presentation of intermittent exotropia. About 41.1 % of the exotropic children had convergence insufficiency. In this study sample 55.8 % of the exotropes were boys showing roughly equal predisposition in terms of gender. Some studies reveal that women comprise 60-70 % of patients with exotropia with intermittent exotropia nearly twice as common in girls compared with boys.<sup>22</sup>

The age at diagnosis is different for the various forms of strabismus in this population. In an incidence cohort study the median age at diagnosis of esotropia and exotropia was 3.1 years & 7.2 years. In the first six years of life, esotropia had the highest incidence; exotropia predominated between age seven and 12 years.<sup>23</sup> There

was insignificant difference between the median age of diagnosis of exotropia and esotropia (4.5 years, 5 years) in our study. The median age of diagnosis of congenital esotropia was 1 year.

We observed that more boys presented in the OPD with strabismus, additionally boys presented comparatively earlier. A study done by Aga Khan University in Karachi also revealed that girls with squint presented much later compared to boys. They also found a higher prevalence of amblyopia in girls. They suggested that this difference may be due to the preferential care given to boys over girls in our society, socioeconomic status and health care seeking behavior. Girls usually present when there is significant deviation of eyes causing social stigma. Furthermore, they found a median delay of 2 years in the presentation of strabismus. They suggested that the delay could be due to poor awareness among people regarding squint and its treatment or due to lack of proper health referral system and scarcity of trained personnel and eye care services.<sup>24</sup>

In our study, 7.7 % children were diagnosed with pseudostrabismus. Research shows that prevalence of strabismus is higher in patients who were initially diagnosed with pseudostrabismus.<sup>25</sup> Therefore, pseudostrabismic children especially those with abnormal BSV vision or visual acuity should be followed-up for the risk of development of strabismus.

In Pakistan there are few if any screening programs for the assessment of visual acuity and squint for children of school going age. Several factors are responsible for late presentation of strabismus in children; lack of awareness, failure to recognize the deviation by the family, affordability, non-availability of the pediatric eye care and cultural deterrents to compliance. Early detection of amblyopia and institution of appropriate therapy is of

immense value towards preventing lifelong visual morbidity.

Considering the implications of childhood strabismus inclusion of cover testing by trained examiners in childhood vision screening programs therefore not only would lead to an increased detection of strabismus but also is likely to point to a group of children who are at a high risk of having significant (often uncorrected) refractive errors and reduced visual acuity. This epidemiological study provides significant insight into the type and distribution of patients with strabismus across Pakistan and South East Asia.

ACCO (Al-Shifa Center for Community Ophthalmology) runs one of the widest outreach programs for the prevention of blindness in the country. It conducts school screening programs, free eye camps, awareness and primary care session for students and teachers. Based on this clinical study we have planned to introduce and augment our screening programs specifically targeting school teachers and pediatrician.

The frequency distribution data from such studies also play a pivotal role in planning, management and allocation of resources in government and private institutions. This frequency study also warrants the need for development of new and improved pediatric ophthalmology clinics and screening programs that focus on primary prevention.

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## Dry Eye Disease and Contact Lens

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### Abstract:

**Objectives:** To study the ocular surface, tear film and factors of dry eye disease (DED) in contact lens wearers.

**Subjects and Methods:** This cross-sectional study was conducted at Federal Government Services Hospital Islamabad from January 2014 to Jan 2015. A total of 227 subjects, age ranging 25-48 years, attending eye OPD/refraction clinic were selected after taking their consent and permission from Ethical committee. Dry eye questionnaire (DEQ) was administered by a trained researcher while Dry eye tests were performed by a single surgeon under the same physical conditions. DED is defined as the simultaneous presence of symptoms and at least one sign. Data analyzed for simple percentages.

**Results:** In this study, 72 (57.2%) of lens wearers had dry eye disease. Thirty (23.4%) were undiagnosed as dry eyes while 25 (19.4%) subjects needed to remove CL. Fifty one 71% women using CLs had DE compared to 29% male among younger age of 25-36 years and they belong to educated group compared to non-contact lens wearers. Computers office workers/students 24% and 21% smokers noted more DE symptoms.

The common symptom of dry eyes in CL users was dryness (73.5%) while tired eyes (77%) was most common symptom in non CL wearers. Among CL users 29% reported discomfort in the morning that increased to 77% in the evening.

**Conclusion:** DE symptoms were present in CL wearers than in non CL wearers. The severity increased at the end of the day among smokers and prolonged computer users. *Al-Shifa Journal of Ophthalmology 2018; 14(4): 191-196. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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### Introduction:

The tears are vital in life. In the fourth to fifth century B.C, Hippocrates classified ophthalmic condition as dry or humid.<sup>1</sup> Dry eye definition is deficient tear production or excessive tear evaporation and unstable tear film resulting in ocular discomfort. Dry Eye Workshop described contact lens-related dry eye disease as evaporative type.<sup>2</sup>

About 10- 30% of the population had dry eyes resulting in up to 90 million Americans where the incidence is higher in women and age over 40 years.<sup>3</sup> There are about 100 million contact lens wearers world-wide and about 35 million contact lens wearers in the United States. A recent international survey of 13,787 contact lens fits showed that the average age is 30.6 years and that about two-thirds of them are female.<sup>4</sup>



Half of contact lens users report dry eye symptoms. They are 12 times more than emmetropes and five times more than spectacle wearers to report dry eye symptoms.<sup>5</sup> About three-quarters of patients discontinue contact lens (CL) wear at one time or another.<sup>6</sup>

During blinking, the pre-lens tear film (PLTF) makes uniform coating over CL. A CL divides the tear film into pre-and post-lens tear films.<sup>7</sup>The superficial lipid layer evaporates from (PLTF) causing CL dehydration. After prolonged use a CL damages the meibomian glands resulting in unstable tear film. It leads to scattering of light and disturbs image quality.<sup>8</sup> The meibomian gland is an androgen target organ and the tear film is a three-layer solution covering the ocular surface. A more recent model of the tear film suggests more of a two-layer structure, with a superficial lipid layer and an underlying aqueous layer with dissolved mucus concentrated at the glycocalyx. The present study evaluates the dry eye like problems experienced by contact lens wearers.

The Contact Lens Dry Eye Questionnaire (CLDEQ) was developed to measure DE symptoms among contact lens wearers ten years ago like Dry Eye Questionnaire (DEQ) for use in non-CL wearers.<sup>9</sup>

### **Subjects and Methods:**

One hundred and twenty seven willing contact lens users along with 100 non-contact lens users of the same age and gender as a control group from refraction side age ranging 25 to 48 years, females were 166 (73.2%) and males 61(26.8%) attending Federal Government Services Hospital Islamabad were invited to undergo study survey for DE after permission from Ethical committee according to protocol of National Health and Nutrition Examination Survey (NHANES). Those having poor CL hygiene behavior were excluded from the study.

Ninety-eight (77.1%) subjects were using soft CLs, 15.7% were having soft toric CL users and 7% were wearing silicone hydrogel CLs. Questions about the age, gender, symptoms, duration, occupation, smoking status, reasons for discontinuation and mode of relief were inquired. All were asked about dry, scratchy or watery eyes. Dry eye tests, like tear film break-up time (TBUT) <10 seconds, Schirmer test (ST) <or=5 mm in 5 minutes, cornea fluorescein staining (CFS)>I score and slit-lamp examination were performed for Lid plugging or mucous threads on each subject. Diagnosis was made on three out of five parameters based on Dry eye workshop (DEWS 2007) guidelines. Data analyzed for frequencies/percentages.

### **Results:**

The dry eye questionnaires for control group and for CL users were completed by 227 subjects (100 DEQ, 127 CLDEQ). Females were 166 (73.2%) and males 61(26.8%), 53% of age group 25-36years and 47%from 37-48 years. Among those 31% were students, 26%office workers, 12% bankers, 8% doctors and 23% smokers.

In this study 57.2% of lens wearers had dry eye disease. 23.4% were undiagnosed as dry eye while19.4% of those needing to remove CL. In the control group 13% subjects were symptomatic having DE symptom often or all the time. (Table-1)

The most reported symptom of CL wearers was burning (73.5%) followed by dryness (64%) while tired eyes (61%) was the most common symptom in non-contact lens wearers. Twenty-five percent of patients reported “never” and 41% reported this symptom as “often.” Thirty percent of CL wearers reported dryness as “constant. About 29% of CL users reported discomfort in the morning that increased to77% in the evening. The dry eye symptoms were noted in students using computer for more than 3 hours daily and in smokers of 3 years duration.(Table-11). Contact lens wearers in general reported more dryness and

burning than non-lens wearers, 57.2% to 13%, respectively.

The daily wearing time of contact lens determined in this study ranged from 4 to 16 hours/day and mean value was  $9.82 \pm 2.19$  hours/day. The years of contact lens use found in this study ranged from 1.5 to 30 years with a mean value of  $8.35 \pm 5.81$  years. (Table-111). In this study very high proportion of contact lens users were myopic (96 %). Minus power of contact

lens ranged from -0.50 to -17.00 D with a mean value of  $-4.46 \text{ D} \pm 3.69\text{D}$ . The proportion of hyperopic contact lens users was less (4%) and plus power of contact lenses ranged from +2.00 to +5.00 D with a mean value of  $+4.00\text{D} \pm 1.35 \text{ D}$ .

All dry eye tests were performed on each patient and the result showed that 41% had decreased Tear film breakup time, 32% had low Schirmer test value, 27% had positive fluorescein staining and 13% had lid telangiectasias or plugging. (Table-iv)

**Table-I Distribution of gender with DE symptoms among CL users and non-CL users**

Symptoms lens users	Contact lens users		Non-contact	
	Male	Female	Male	Female
Contact lens users	18(14.1%)	109(85.9%)	20(20%)	80(80%)
DE symptoms	21/72(29.1%)	51/72(71%)	5/13 (38.4%)	8/13 (61.5%)
No DE symptoms	8/30(26.6%)	22/30(73.4%)	47/87(54%)	40/87 (46%)

**Table- II DE symptom among CL users and non CL users**

Symptoms	CL Users (n=127)	Non-CL users (n=100)
Dry eye disease	72(57.2%)	13(13%)
Burning eyes	93 (73.2%)	24 (24%)
Dry eyes	82 (64%)	41 (41%)
Tired eyes	73(57.4%)	61 (61%)
Blurring vision	72 (56.5%)	30 (30%)
Discomfort	68 (53%)	35 (35%)
F.B sensation	66 (51%)	22 (22%)

**Table-III Timing of DE symptom among CL users and non CL users**

Symptoms	Contact Lens Users	Non-contact lens users
Morning Dryness	37(29%)	15(15%)
Evening Dryness	98 (77%)	28(28%)
Computer use >3hr	30(24%)	15(15%)
Smokers>3years	26(21%)	19(19%)
Improper fitting	16(12.5%)	-----
CL use/day	4-16hrs/day	-----
CL use duration	1.5-30yrs	-----

**Table-IV DE tests among CL users and non CL users**

Test	CL Users (n=127)	Non-CL users (n=100)
TBUT	52(41%)	11(11%)
ST	41(32.2%)	5(5%)
CFS	34(27%)	9(9%)
LIDS	16(13%)	8(8%)

**Discussion:**

Dry eye disease is defined by decreased tear production, increased tear evaporation or tear instability. These factors reduce lubrication of the conjunctiva and cornea. Other risk factors are aging, contact lens wear, medications, long computer work or reading environment and Lasik.<sup>10</sup>

The tear film is a three-layer solution covering the anterior ocular surface. Lipids are released from the meibomian glands through the holocrine mechanism. Studies confirm hormonal control of the glands.<sup>6</sup> About 35 million Americans wear contact lenses. Over 70% of contact lens users were female<sup>2</sup> is akin to present study. In another study the average age of CL user was 31 years. Ten percent of contact lens wearers were under 18 years old, 15% were between ages 18-24, 50% were between ages 25-44 and 25% were of age 45 or older.<sup>4</sup> In our study 53% were of 25-36years age group and 47% from 37-48 years age group.

CLs aggravate and also cause dry eye disease. CL-related dry eye may complain of dryness, burning, discomfort and foreign body sensation. DED is a common problem of both CL wearers and non-wearers but symptoms were more severe in contact lens wearers in this study.<sup>11</sup>

About 25%-75% of CL wearers complain dry eye symptoms. In this study more than half the number of lens wearers reported dryness compared to non-lens users similar to other study where up to 75% of CL wearers had symptoms of ocular burning.

Dryness was the most common symptom across many studies.<sup>12</sup>

A USA survey on the management of DE symptoms reported that 18% to 30% of soft contact lens (SCL) user had DE symptoms, 12% to 21% needed to reduce their CL wearing time and 6% to 9% removed contact lenses due to DE symptoms.<sup>13</sup> In present study burning, dryness and discomfort with SCL use was about 50% double than non-contact lens users, who discontinued lens wear to relieve DE symptoms. The Canadian DE study showed the prevalence to be 27.8% as determined by patient questionnaires.<sup>14</sup>

Our study showed that all DE symptoms were present in contact lens users compared to non-contact lens wearers is similar to other study.<sup>12</sup> Beglay et al. reported that the most common ocular symptom was dryness and the least was soreness among 83 contact lens wearers through a survey questionnaire.

In the present study 11% had plugging of meibomian openings showing meibomian gland dysfunction (MGD). This is similar to other study showing MGD created contact lens intolerance.<sup>15</sup> Interestingly in this study subjects reported more symptoms in the evening than in the morning time. Reason may be deposit formation during a day making the lens surface hydrophobic. Studies noticed a mucus coating over the anterior surface of contact lens after about 30 minutes of lens wear.<sup>16</sup> It is shown that low TBUT,(41%)in our study, and lens deposits create DE symptoms.<sup>17</sup> This study

revealed that the symptoms increased more than twice in the evening than in the morning. Ocular surface symptoms such as discomfort and dryness are reported as the main cause of discontinuation for CL. One study showed that 12% of CL users discontinued permanently within five years of lens wear.<sup>18</sup> In this study 19% needed to remove the CLs.<sup>19</sup>

In this study 31% students had DE symptoms after computers use. The frequency of these symptoms were related to the duration of computer use similar to other study.<sup>20</sup> In this study ocular irritation was more common in females using oral contraceptives<sup>21</sup> and in patients with high refractive errors similar to other study.<sup>22</sup> CL wearers noted more problems with central heating/air conditioning<sup>23</sup> and smoky environments than non-CL wearers.<sup>24</sup> is similar to present study. These findings supported the evaporative etiology of contact lens-related dry eye.<sup>10</sup>

12.5% of the subjects in present study had constant foreign body sensation. Reason being improper lens fittings is similar to other study.<sup>25</sup> Whatever the symptoms be present all CL users have tear instability. CL-related dry eye mechanism is multifactorial, but knowledge of symptoms is a good outcome measure.

### **Conclusion:**

The secret of contact lens wear success depends on tear film stability. Oxygen permeability of contact lenses is vital as cornea receives oxygen through atmosphere.

This study had some limitations. We discussed frequency of the symptoms but not the intensity. We only inducted the current CL users. Those who discontinued CLs were not included.

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## Trabeculectomy Under Topical Anesthesia

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### Abstract:

**Objective:** To determine the efficacy of proparacaine hydrochloride 0.5 % topical anesthetic during the procedure of Trabeculectomy in patients with glaucoma in terms of pain perceived by patients.

**Materials and Methods:** This descriptive case series was conducted at Al-Shifa Trust Eye Hospital, Kohat 15th April 2015 to 15th November 2018 (2 years and 6 months). A total of 55 patients were included in the study based on inclusion and exclusion criteria. Proparacaine hydrochloride 0.5 % was used as a topical anesthetic agent. Pain was recorded intra-operatively on the Visual Analog Scale (VAS) with readings every ten minutes till the end of the surgical procedure. Data were analyzed for descriptive statistics on SPSS 17.0.

**Results:** The ages of patients ranged from 15-70 years with a mean age of 43.85±13.27 years. Intra-operative pain perception by patients on VAS (Visual analogue scale) was 0 in 28(50.9%) patients, 1 in 10 (18.2%) patients, 2 in 02(3.6%) patients and 3 in 15(27.27%) patients. There were no intra-operative complications; however, slight sub-conjunctival hemorrhage was noted in some patients during the injection of sub-conjunctival anesthesia.

No supplementary topical or injectable anesthesia or intravenous sedation was required during the procedure. Squeezing of the lids was noted in 12(21.81%) patients, inadvertent eye movements in 12(21.81%) patients and sub-conjunctival hemorrhage in 10(18.18%) patients. Efficacy was achieved in 40(72.72%) patients, while efficacy was not achieved in the remaining 15 (27.27%) patients.

**Conclusion:** Use of Proparacaine hydrochloride 0.5% as topical anesthesia is safe and provides adequate anesthesia for trabeculectomy. *Al-Shifa Journal of Ophthalmology 2018; 14(4): 197-202.* © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

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### Introduction:

Cataract and Glaucoma surgery make up the most common eye diseases requiring elective surgical intervention. A survey conducted by Royal College of Ophthalmologists has shown that local anesthesia is the anesthetic technique of choice for intra-ocular surgery in adults.<sup>1</sup> Development of better surgical skills and facilities has rendered general anesthesia largely unnecessary.<sup>2</sup> Different anesthetic techniques commonly practiced are retrobulbar, peribulbar and sub-tenon's infiltration.<sup>3-5</sup> While providing excellent conditions for operating on the eye, these techniques are occasionally associated with serious side effects like respiratory arrest as a result of brain stem anesthesia.<sup>6,7</sup>

The sub-conjunctival and topical application of local anesthesia may provide an excellent method of anesthesia while avoiding the serious side effects. The topical anesthesia however is not very frequently used for trabeculectomy as compared to phacoemulsification.<sup>8-10</sup>

A study was conducted for comparison of topical and retro-bulbar anesthesia for Trabeculectomy in terms of patient comfort and surgical outcome which included 36 patients out of which 18 patients underwent under local anesthesia while rest of 18 patients were given topical anesthesia, 4 of which felt pain and were given local anesthesia in order to proceed for surgery, while rest of 14 patients remained pain free during the procedure. Thus, the expected percentage of efficacy under topical anesthesia was 78% which shows that topical anesthesia is safe and effective alternative to retro-bulbar anesthesia for primary trabeculectomy.<sup>11</sup> Topical anesthesia is still used very rarely in our local setup despite being used internationally. We use local and general anesthesia, which have their own complications (as described above). The purpose of current study was produce local reference of this subject to encourage use of this safe & effective anesthetic option.

### Materials and Methods

It was a descriptive case series conducted in A-Shifa Trust Eye Hospital, Kohat, from 15th April 2015 to 15th November 2018, (2 years and 6 months). The calculated sample size was 55 cases with 95% confidence level, 11% margin of error and taking expected percentage of efficacy of topical anesthesia that is 78% during surgical procedure of Trabeculectomy in terms of pain during surgery. Non-probability purposive sampling was carried out. All glaucoma patients between ages 15-90 years and of both genders, in whom trabeculectomy was indicated, determined by slit lamp examination and record of Intra Ocular Pressure (IOP), were included in the study. Patients with communication

problems and/or exaggerated anxiety states were excluded, as they could provide non-representative VAS responses.

The patients meeting the selection criteria were selected from Out Patient Department (OPD) of Al-Shifa Trust Eye Hospital. After taking informed consent and detailed clinical and socio-demographic history, each patient underwent clinical examination and was shown Visual Analog Pain Scale (VAS) and explained. All the procedures were performed by a senior surgeon. No sedation other than the topical anesthesia was used. No suture was applied for the exposure (i.e. corneal or superior rectus). All the patients received a total of five doses of 2 drops of proparacaine hydrochloride 0.5 % topical anesthetic just before and during surgery. After complete sterile draping and proper exposure 0.3ml of 2% xylocaine was injected at the proposed site of Sclerostomy to raise conjunctival bleb. The Trabeculectomy was performed with fornix-based conjunctival flap. The degree of pain experienced during operation was assessed after every ten minutes by asking patient to score on numerical scale (0-10). Categorization of pain scores is shown in Table 1. Five categories were devised, ranging from No Pain to Unbearable Pain, based on the patient response recorded on the VAS. Efficacy was labeled if pain score remained  $\leq 2$  at each reading during the procedure.

### Visual analog numerical pain scale of patients

#	Pain categories	VAS ratings
1	Unbearable pain	08 -10
2	Severe pain	06 – 07
3	Moderate pain	03 – 05
4	Mild pain	01 – 02
5	No pain	00

All data were recorded on a pre-designed proforma. Data were entered and analyzed in SPSS version 17. The quantitative variables like age and VAS scores were presented by calculating mean and standard deviation. Gender and efficacy of the

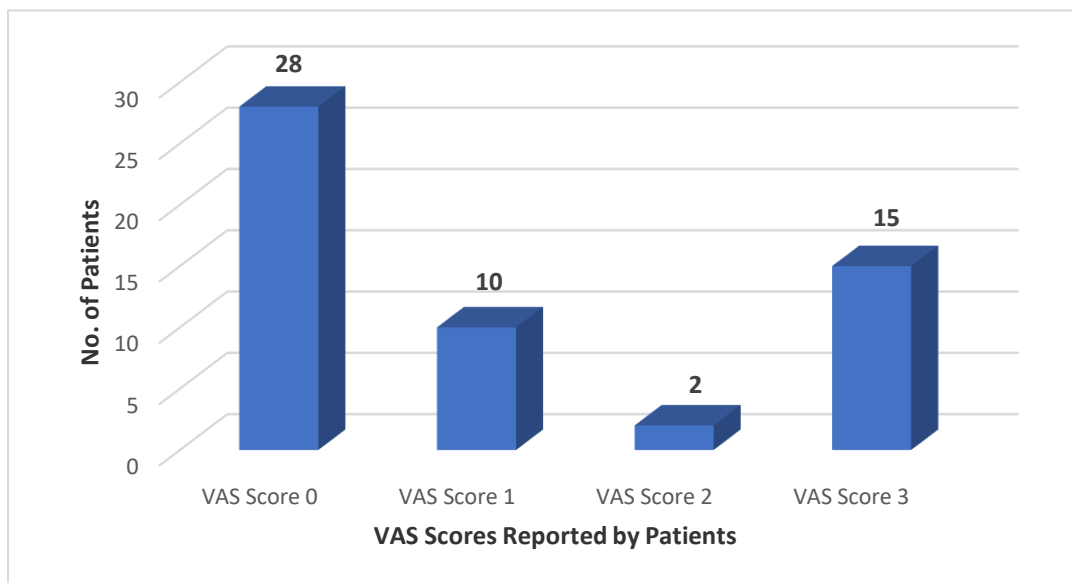
topical anesthesia was presented by calculating frequency and percentage.

**Results:**

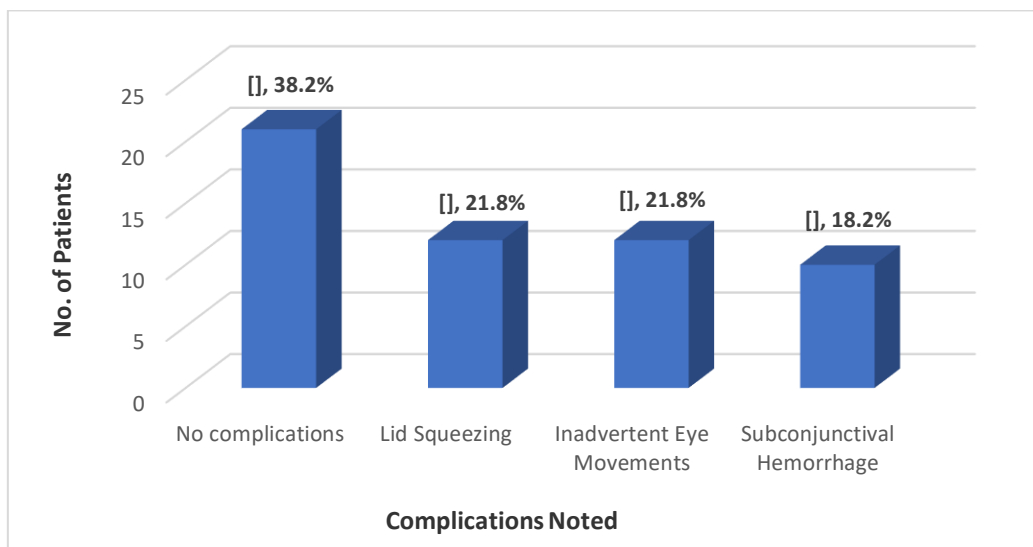
The patients' ages ranged from 15-70 years with mean age of  $43.85 \pm 13.27$  years. There were 28(50.90%) male patients and 27(49.09%) female patients.

There were no intra-operative complications except slight sub-conjunctival hemorrhage, which occurred during the injection of sub-conjunctival

anesthesia. The assessment of pain by the patient during the procedure of trabeculectomy, on the visual analog scale was 0 in 28(50.9%) patients, 1 in 10(18.2%) patients, 2 in 02(3.6%) patients and 3 in 15(27.27%) patients, as shown in Figure 1. There was no supplementary anesthesia required in the form of topical, injectable or intra-venous sedation. Squeezing of the lids was noted in 12(21.81%) patients, inadvertent eye movements in 12(21.81%) patients and sub-conjunctival hemorrhage in 10(18.18%) patients.

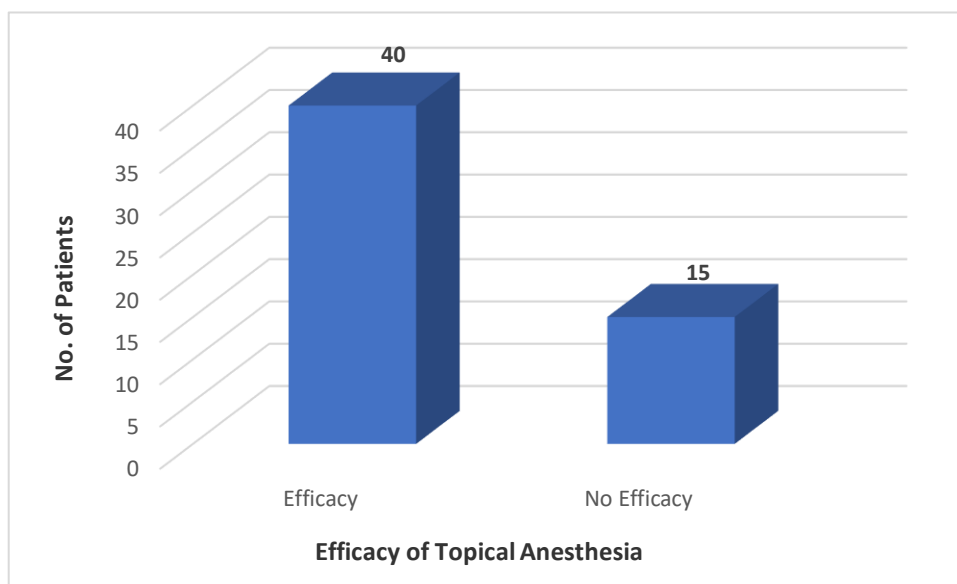


**Figure 1: Per-operative pain reported by patients based on the Visual Analog Pain Scale (VAS) (n=55)**



**Figure 2: Complications related to topical anesthesia noted during trabeculectomy in patients (n=55).**





**Figure 3: Efficacy Distribution of Patients based on per-operative pain perception by VAS (n=55).**

### **Discussion:**

For ocular surgery different methods of anesthesia are used, which include General anesthesia, peri-bulbar,<sup>4,5,12</sup> retro-bulbar,<sup>3,13</sup> sub-tenon's infiltration,<sup>3,14-16</sup> sub-conjunctival and topical form of local anesthesia,<sup>8,9</sup> either in the form of ocular drops or ocular jelly. As nowadays cataract surgery is largely performed under topical anesthesia,<sup>17</sup> so this form of anesthesia may be considered as an attractive alternative of anesthesia for the procedure of Trabeculectomy as well. Topical anesthesia is effective in not only it avoids serious complications associated with retro-bulbar anesthesia but also that it does not require patching of the eye in post-operative period, makes the recovery rapid; it is a pain free method and also cost-effective.<sup>18</sup> Retro-bulbar injection may cause increase intra-orbital pressure and retro-bulbar haemorrhage<sup>19</sup>, which may damage the optic nerve.

Ritch and Liebmann in their study reported the efficacy of sub-tenon's anesthesia for the procedure of Trabeculectomy, which indicated that retro-bulbar anesthesia is not essential for this purpose. Trope GE and

Buyts YM also carried out study to compare the efficacy of sub-tenon's vs retro-bulbar anesthesia, further strengthening the idea of avoiding retro-bulbar form of anesthesia for Trabeculectomy. Another prospective study was carried out by Carrillo and Buyts, which compared topical anesthesia with sub-tenon's injection. This study concluded that the topical anesthesia is equally effective.<sup>20-22</sup>

Lai and Tham conducted a prospective study on 22 patients, all of whom had undergone combined phaco-trabeculectomy procedure, and they concluded that the topical 2% lignocaine jelly alone without the use of sedation was able to get adequate analgesia.<sup>23</sup>

In another study which was conducted by Zabriskie NA, Ahmad IIK, and others<sup>24</sup> compared the safety and the efficacy of topical vs retro-bulbar anesthesia in terms of operating conditions, patient comfort and surgical outcome. They reported that for primary trabeculectomy, topical anesthesia is a safe and effective alternative as compared to retro-bulbar anesthesia.

In the present study, the efficacy of the topical anesthesia was demonstrated in terms of reduction of pain as reported by the patient through use of Visual Analog Scale. There were no other serious complications which were observed during the application of the anesthesia or during the surgery; hence, it may be considered as effective and safe method of anesthesia not only in routine trabeculectomy but also in cases of advanced glaucomatous optic nerve damage and in only eye patients undergoing trabeculectomy.

### **Conclusion:**

Use of Proparacaine hydrochloride 0.5% as a topical anesthetic for trabeculectomy is safe and effective in providing adequate anesthesia.

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# Diagnostic Accuracy of Optical Coherence Tomography in Early Detection of Choroidal Neovascularization in Age Related Macular Degeneration

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## Abstract

**Objectives:** To compare the the diagnostic accuracy of optical coherence tomography (OCT) with fundus fluorescein angiography (FFA) in the early detection of choroidal neovascularization in patients with Age Related Macular Degeneration taking FFA as gold standard.

**Subjects and Methods:** A cross sectional study was conducted at one center for 6 months. Two hundred and five patients were enrolled using strict inclusion/exclusion criteria and studied for early detection of CNV in patients with age related macular degeneration. A pair of FFA and OCT images from the same visit was taken from each selected patient and was assessed by same observer. The results of both diagnostic tests were compared determining the diagnostic accuracy of OCT with FFA.

**Results:** A total of 205 cases were included in the study. All cases were between 50-80 years of age, mean was calculated as 65.52, 57.56% (n=118) were male and 42.44% (n=87) were females. Frequency of CNV on FFA was recorded as 38.54% (n=79). Diagnostic accuracy of OCT vs FFA in the early detection of CNV in patients with age related macular degeneration taking FFA as gold standard was calculated which shows sensitivity, specificity, positive predictive value, negative predictive value and accuracy rates as 89%, 73.02%, 67.62%, 92% and 79.51% respectively.

**Conclusion:** Optical coherence tomography (OCT) has higher diagnostic accuracy compared to FFA in the early detection of CNV in patients with Age Related Macular Degeneration. *Al-Shifa Journal of Ophthalmology 2018; 14(4): 203-209. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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## Introduction:

Age Related Macular Degeneration (AMD) is a degenerative disease of central portion of retina (the macula) characterized by specific clinical findings like the presence of drusens (accumulations of yellow deposits in the macula), retinal pigment epithelial (RPE) changes and/or choroidal neo-vascularization (CNV).<sup>1</sup> It is the leading cause of blindness in developing countries in the world.<sup>1</sup> The prevalence of AMD in people over 40 years of age is 6.5% in USA.<sup>1</sup> The overall prevalence of neo-vascular AMD is 1.2% in people aged 50 years in a study conducted in UK.<sup>2</sup> Blindness prevalence studies in Pakistan,

Bangladesh and Nepal have also reported rates of 2.1% to 8.7% for all blindness attributable to AMD. Age-related macular degeneration is therefore a significant cause of visual morbidity in these countries.<sup>3</sup>

AMD prevalence is strongly age related. Overall, AMD was present in 0.2% of the combined population aged 55 to 64 years, rising to 13% of the population older than 85 years in a study conducted in three racially similar continents.<sup>4</sup> Age-related macular degeneration (AMD) is a clinical diagnosis based upon symptoms and evaluation of optic fundus on dilated eye examination using a slit lamp instrument.<sup>5</sup> AMD is classified as dry (early, intermediate) or wet (neo-vascular or advanced) for clinical purposes.<sup>5</sup> The striking features of dry AMD are sub-retinal drusen deposits, focal or more widespread geographic atrophy of the retina and retinal pigment epithelium (RPE) changes.<sup>5</sup> Meanwhile, in wet AMD dilated examination may reveal sub-retinal fluid and/or hemorrhage appearing as grayish green discoloration in the macula.<sup>6</sup> Diagnostic accuracy relates to the ability of a test to discriminate between the disease and health. This discriminative potential can be quantified by the measures of diagnostic accuracy such as sensitivity, specificity and predictive values.<sup>7</sup>

Fundus fluorescein angiography (FFA) is the gold standard test for the diagnosis of CNV and depending upon the FFA findings CNV are classified as CLASSIC and OCCULT types.<sup>8</sup>

Optical Coherence Tomography (SD-OCT + time domain OCT) is an imaging technique that produces high-resolution cross-sectional images of the retina based on the optical reflectivity of the tissues. It provides high-resolution anatomic images of the posterior segment of the eye (vitreous, retina, retinal pigment epithelium and anterior choroid). These images can be used to identify retinal edema and/or sub-

retinal fluid that appears on OCT as well circumscribed hypo-reflective spaces and can be evaluated quantitatively.<sup>9</sup> Recent studies show that SD-OCT is superior to time-domain OCT in detecting sub-retinal, sub-RPE, and intraretinal fluid, making it better for evaluation of CNV activity.<sup>10-13</sup>

Study trials (MARINA and ANCHOR) used ranizumab for the treatment of CNV associated with neo-vascular AMD demonstrated dramatic results which revolutionized the treatment of neo-vascular AMD but they had some drawbacks. Fluorescein angiography was commonly used as an indicator of CNV activity in above trials; however, several reports have indicated inability of FFA to differentiate between leakage and staining and poor agreement in interpretation of fluorescein angiography in neo-vascular AMD between physicians, especially after treatment.<sup>14</sup>

PrONTO Study (Prospective Optical Coherence Tomography Imaging of Patients with Neo-vascular Age-Related Macular Degeneration Treated with intra ocular Ranibizumab)<sup>18</sup> showed that often the presence of retinal fluid could be detected much earlier by OCT than FA, leaving the door open for a greater role of OCT in treatment monitoring. New multicenter studies (SAILOR or SUSTAIN) included a larger number of patients and confirmed the role of OCT in patient monitoring. In some studies OCT has been validated against fluorescein angiography, the gold standard, in the evaluation of retinal vascular leakage.<sup>11, 15-17</sup>

The rationale of this study is to determine the diagnostic accuracy of OCT vs FFA in detection of CNV as there is no previously done local study on this aspect in our population and many international studies have shown a lot of controversy in results. The study may save the patients from the adverse effects of fluorescein in future.

## **Subjects and Methods:**

*Study design and setting:* A cross-sectional study carried out at Eye Unit III, Institute of Ophthalmology, King Edward Medical University/ Mayo Hospital Lahore.

*Duration:*

Six months after approval of Synopsis.

*Sample size;*

The study population was 205.

*Sampling technique:*

Non-probability purposive sampling was used.

*Inclusion & Exclusion Criteria:* Patients of both genders between 50 to 80 years with AMD and suspected CNV on indirect ophthalmoscopy and patients diagnosed as having AMD in the last 6 months were included in the study. Patients having significant media opacity (Cornea, Aqueous, Lens, Vitreous) on slit lamp examination, known allergy to fluorescein dye or any other kind of allergy, any evidence of macular diseases (pattern dystrophy, diabetic macular edema, vitreo-macular traction etc) other than AMD, any previous history of surgical or laser treatment to the eye and diabetic retinopathy on indirect ophthalmoscopy were excluded from the study.

*Data Collection Procedure:*

After approval from institutional review board of hospital for ethical issues, 205 patients fulfilling the inclusion and exclusion criteria were selected from outdoor of eye unit III Institute of Ophthalmology KEMU/MHL. After taking informed written consent, both tests were performed on each patient. The risks like (generalized skin itching, sensitivity on exposure to light due fluorescence dye, nausea, vomiting) and benefits (early detection and proper management in stopping or slowing down the disease) were explained to the patients. The initial preparation for both the tests is same that is pupil should be dilated. For both the tests, the patients were made to sit comfortably in front of the camera and shown a target to fix the eyes. For OCT the machine was

adjusted manually as well as by auto-focusing on the Fundus and during autofocusing getting green signal from machine showed that focus is sharp enough and then the image was taken.

For FFA after showing the target to fix the eyes, two types of images was taken, that is, early and late, using three types of filters (red, red free, fluorescence). The test was started with images of red filter followed by red free filter. With the help of an assistant, dye was injected in a superficial vein of the arm or hand and early filling phase fundus photograph were taken. After an interval of 10 minutes, when the dye was completely phase out of eye, the late phase photograph was taken. Both the tests were performed by the investigator himself, reporting was done by a single consultant to avoid biasing and all the data was collected through pre designed performa.

*Data Analysis*

The data was analyzed on SPSS version 20. The frequency and percentages were calculated for qualitative variables like CNV on OCT and FFA, and Gender. Mean and standard deviation was calculated for quantitative variable like age. 2x2 tables was used for calculation of diagnostic accuracy variables.

## **Results:**

A total of 205 cases fulfilling the inclusion/exclusion criteria were enrolled to determine the diagnostic accuracy of OCT with FFA in the early detection of CNV in patients with Age Related Macular Degeneration taking FFA as gold standard. Age distribution of the patients was done which shows that 45.37% were between 50-65 years of age and 54.63% were between 66-80 years of age, Mean $\pm$ SD was calculated as 65.52 $\pm$ 6.93 years. Patients were distributed according to gender, where 57.56% were male and 42.44% were females. Frequency of CNV on FFA was recorded in 38.54% (n=79) while 61.46% (n=126) had no findings of CNV (Table No. 1).

Diagnostic accuracy of OCT with FFA in the early detection of CNV in patients with age related macular degeneration taking FFA as gold standard was calculated and presented where out of 79 cases of CNV, 34.63% were true positive, 16.59% were

false positive, 3.90% false negative and 44.88% were true negative, sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate was calculated as 89%, 73.02%, 67.62%, 92 and 79.51% respectively. (Table2)

TABLE No. 1  
Frequency of CNV ON FFA (n=205)

CNV	No. of patients	%
Yes	79	38.54
No	126	61.46
<b>Total</b>	<b>205</b>	<b>100</b>

TABLE No. 2  
Diagnostic Accuracy of OCT with FFA In The Early Detection Of CNV in Patients With Age Related Macular Degeneration Taking FFA As Gold Standard (n=79)

OCT	FFA	
	CNV (Positive)	CNV (Negative)
Positive	True positive(a) 71 (34.63%)	False positive (b) 34 (16.59%)
Negative	False negative(c) 8 (3.90%)	True negative (d) 92 (44.88%)

$$\text{Sensitivity} = a / (a + c) \times 100 = 89\%$$

$$\text{Specificity} = d / (d + b) \times 100 = 73.02\%$$

$$\text{Positive predictive value} = a / (a + b) \times 100 = 67.62\%$$

$$\text{Negative predictive value} = d / (d + c) \times 100 = 92\%$$

$$\text{Accuracy rate} = a + d / (a + d + b + c) \times 100 = 79.51\%$$

**Discussion:**

This study was planned to determine the diagnostic accuracy of OCT vs FFA in detection of CNV. Fundus fluorescein angiography (FFA) interpreted by an ophthalmologist in the recent past was the reference standard for the detection of active neo-vascular AMD because it directly detects the presence of the active neovascularization. However, FFA is an invasive and a time-consuming test with potentially serious, although rare, side effects. Other alternative monitoring technologies are available, of which the most widely used is optical coherence tomography (OCT).<sup>18-20</sup>

OCT is commonly used to image eyes with AMD, it also is unknown whether periodic OCT testing would improve our ability to identify new-onset CNV relative to standard care practices, or provide information that supplements PHP testing, or is of no value in monitoring AMD patients at risk of CNV.<sup>21, 22, 23</sup>

In our study, out of 205 cases, mean age was calculated as 65.52 years. Frequency of CNV on FFA was recorded in 38.54% (n=79). Diagnostic accuracy of OCT with FFA in the early detection of CNV in patients with AMD taking FFA as gold standard was calculated which shows sensitivity, specificity, positive predictive value, negative predictive value and

accuracy rate as 89%, 73.02%, 67.62%, 92% and 79.51% respectively.

The findings of our study regarding diagnostic accuracy of OCT are in agreement with a study.<sup>16</sup> showing the sensitivity of OCT in 97% while specificity was 37% in CNV detection which is lower than our study. Another study conducted by Do DV Gower et al, the sensitivity of OCT is 40% while taking FFA as gold standard<sup>21</sup>, which is significantly lower than in our study. This low sensitivity may be explained by the use of time-domain OCT, as pathological features may be overlooked more easily compared to SDOCT due to the less dense scan pattern, lower image resolution, and higher rate of movement artefacts.<sup>21, 23</sup> Nils F Mokwa in his study concluded that CNV lesions and activity may be missed by FA alone, but FA may help in identifying drusen and pigmentary changes. SDOCT is highly sensitive for the detection of AMD, CNV, and CNV activity; however, it cannot fully replace FA.<sup>24</sup>

The disagreement between both imaging modalities may be explained by the fact that FA and OCT imaging provides different information about retinal pathology. FA is used to obtain information about the perfusion and the growth of new vessels as well as the integrity of the blood retinal barrier<sup>25</sup>. This information is missing on OCT images which provide detailed information about pathological changes like, for example, the presence of cystoids spaces; however, it is not possible to detect whether they are caused by fluid accumulation from acute leakage from pathological vessels. In contrast, CNV activity seen on FA may be missed on OCT if only intra retinal cystoids spaces and sub retinal fluid accumulation are considered to represent CNV activity on SDOCT.<sup>15, 16</sup> Our findings are in our local population primarily, which needs some other studies to be conducted to confirm the findings of our study. There are chances of selection bias as usually patients at advanced stage

report to tertiary care hospital outdoor but it was minimized by following strict inclusion and exclusion criteria.

### **Conclusion:**

Following the elaboration of relative pros and cons of the two commonly used investigations in ophthalmology, we conclude a higher diagnostic accuracy of optical coherence tomography (OCT) as compared to fundus fluorescein angiography (FFA) in the early detection of CNV in patients with Age Related Macular Degeneration taking FFA as gold standard. This study will serve to shift the diagnostic paradigm of CNV into a more accurate and focused approach for early detection and treatment of disease.

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