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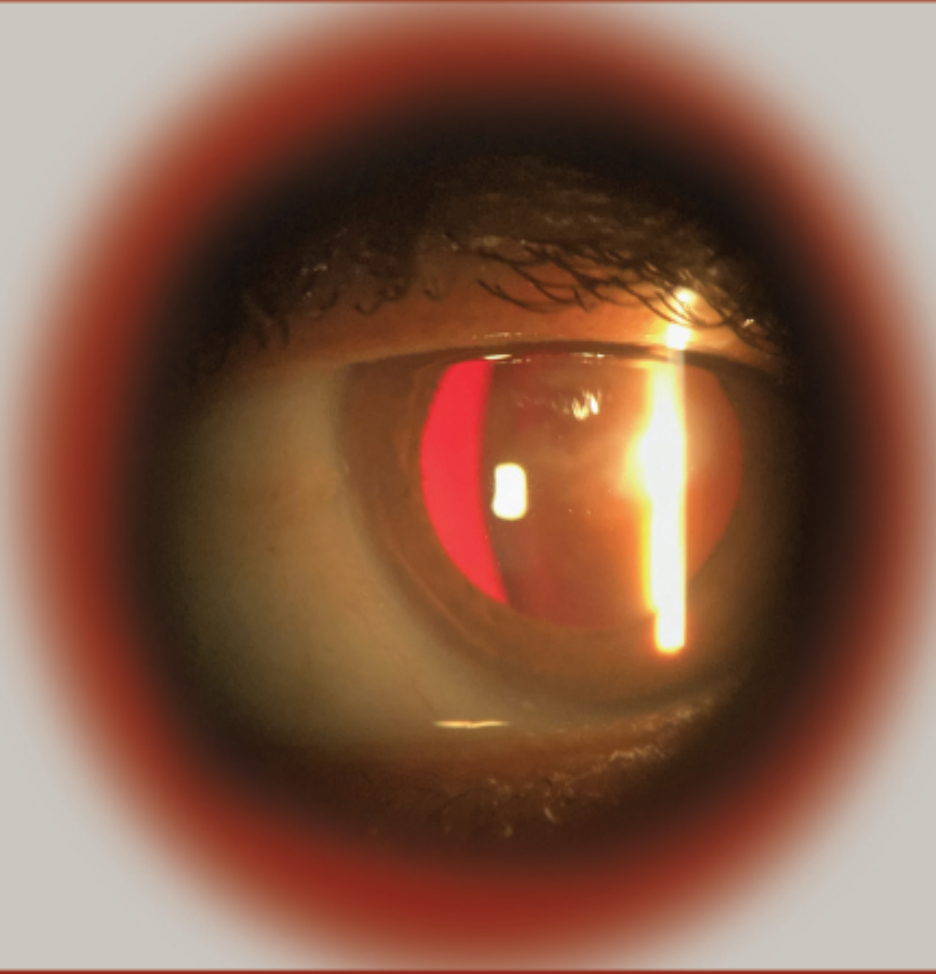
Assam, India



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Vol 6, Issue 1, November 2022


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Guwahati, Assam, India **Vol 6, Issue 1, November 2022**

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[1] Tenure of Executive Body has been extended twice in view of Covid situation; viz., by 1 year upto end 2021 vide GBM 2020, and by 1 year upto end 2022 vide GBM 2021.

Journal of Ophthalmological Society of Assam (JOSA)

Volume 6 Issue 1 November 2022

About the Journal

Journal of Ophthalmological Society of Assam, is the official scientific publication of Ophthalmological Society of Assam (OSA). It is a peer-reviewed open access annual online journal. The full text is available online at http://www.osa.ind.in/journal.htm. The journal allows free access (Open Access) to its contents and permits authors to self-archive the final accepted version of the articles on any OAI-compliant institutional/subject-based repository.

Scope: JOSA covers all aspects of clinical, experimental, basic science, interdisciplinary, multidisciplinary and translational research studies related to ophthalmology and vision science, with a preference for articles of applied interest.

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Editorial

Madhurjya Gogoi
01 November 2022
Guwahati, Assam

Sine the inaugural issue of 2017, the Journal of Ophthalmological Society of Assam has consistently aimed to publish peer reviewed research work in the visual sciences. The pandemic period has been difficult. No doubt, the services have since resumed; but research work continues to lag, as evidenced by only marginally increased submissions.

An attempt has been made to fill the gap with invited articles in the nature of reviews of pertinent topics of general ophthalmology. Select topics, not so mainstream, have also been included. Where possible, scientific deliberations at OSA annual meetings have been covered under 'OSA proceedings'. These include deliberations by international and national experts, brief communications by the practicing ophthalmologist, and initial research efforts at the post graduate level.

JOSA's has followed the 'Open Access' policy. Authors are not charged, and articles can be submitted at any time. Presently, email (journal.osa@gmail.com), is the only mode, but in due course, it is planned to have a dedicated website for wider reach, visibility and ease of access.

JOSA emails the digital copy in PDF format to all life members. As promised, the print issue for years 2020 and 2021 are being made available this year. JOSA has plans to increase the frequency of publication to at least biannual, and go through metrics like indexing, abstracting and impact factor. To facilitate these, an earnest appeal is made to researchers and authors to familiarise themselves with the latest ICMJE recommendations.

JOSA would like to gratefully acknowledge all stakeholders contributors, editorial board members, reviewers and well-wishers, who have taken pains to ensure uninterrupted publications for the initial 6 years. JOSA shall have a new editor in end 2022, and it is hoped that under the new team, JOSA shall grow and touch greater heights.

JOSA fact file:

Year	Received/Invited	Accepted	Under Review	Withdrawn	Rejected
2017	8	7	1	0	0
2018	7	6	0	0	1
2019	15	9	2	2	2
2020	7	4	2	0	1
2021	10	9	0	0	1
2022	15	13	0	0	2
Total	62	48		2	7

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Guest Editorial

Clay can turn into art when in the right hands – The role of a mentor in shaping a mentee's career

Ophthalmology being a surgical field requires a perfect blend of knowledge and skills with universal growth. A clear knowledge about anatomy related to the specific field is mandatory. Surgeons require to know the importance of a multi-disciplinary role i.e. expanded relationships with other departments, collaborative publications and research and eventually validation of their work by publishing in journals with good impact factors.[1] An ideal surgeon must have a clear focus and a positive attitude towards work with willingness to provide for the patients without inertia to work and grow. Academic and administrative qualities with eagerness to innovate and research make a surgeon develop an overall approach towards the patients as well as the institute.

"Your mentors in life are important, so choose them wisely." – Robert T. Kiyosaki

The most important person in a surgeon's journey happens to be a good, self-less and dedicated mentor who is determined to provide the keys to success. Several historical mentor-mentee relationships have led to the origin of great mentees by working under the shadow of legendary mentors. A mentee must assess his/her own capabilities and apply to the ideal mentor. Mentors play an integral role in developing a mentee's clinical aptitude, surgical skills, professional values, discipline, technical expertise and personal growth.[2]

Nassour et al have stated the important elements for optimizing the mentor-mentee relationships. A successful mentor makes time and listens to the mentee's doubts, conducts regular meetings and assess the shortcomings, assess the progress of the mentee on a regular basis, promotes mentees selflessly and celebrates mentee's success like his/her own. [3] At the same time, a mentee can be successful by identifying the ideal mentor, having clear career goals, settingrealistic expectations, being well-organized in the approach towards his/her futurewhile keeping up the productivity.

It is important to make sure that in organization-based setups the mentoring programs are regularly revised to facilitate optimization of the mentor-mentee relationships in the setup. These could be questionnaire based assessments, scales and scores, one-on-one regular meetings or inter-departmental rotations of mentors and mentees.[4,5]

In ophthalmology, a clear knowledge about the correct approach to operation theatre planning, instrument regulation, nursing staff training, intra-operative patient care, surgical technique, documentation, delicate handling of tissues and post-operative care is mandatory.Observation is the key to surgical success and is

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important for the growth and development of the surgical trainee. Often the residents/fellows are eager to operate, but it is important for them to pay attention to details and document the accurate and schematic approach to all the surgeries.[6]

Mentoring not only benefits the mentee, but also helps in the overall development of the mentor.[7] It infuses confidence, improves skills, encourages innovative thinking and inclines towards positive risk taking.[8]Mentoring is not only a challenge but also a very important task. Mentors are able to connect to the younger generation and stay tuned with the recent advances in the process. As they attempt to understand the challenges faced by the mentors, they are able to re-visit the journey with a different and fresh perspective.

McBurney has beautifully stated that a good strategic mentoring is when you are able to start the way you intend to finish.[8] While the mentor attempts at orchestrating a viable system for the mentee by setting specific and focused goals; the mentee is required to be able to understand the wants and needs from the program. If the journey isn't planned, then it might lose the required direction. Therefore, it is important to set goals at the beginning of the journey, assess progress regularly and aim at ensuring fulfilment of all goals by the end of the training duration.

A viable and productive mentor-mentee relationship is difficult to find for a successful surgical training, but once the correct links match, the resultant power is beyond compare. A good surgical mentor acts as a role-model, teaches and coaches the mentee selflessly, advised generously and facilitates decision-making capacity, supports and criticizes with intellectual honesty, supervises without expressing and empowers; and knows when to hold-up-the-mirror to keep the mentee down-to-earth and productive. At the same time, the mentee must stay committed to work and training, establish clear goals, sharpen the surgical skills, ensure good learning and development, read extensively, respect the mentor's advice and training, stay loyal and faithful, be there for the mentor as and when required and perform to the best of his/her capabilities to be able to make the mentor stand proud with his/her head held high. A mentee must understand the importance of each and every pearl of wisdom delivered by the mentor and remember them forever along with passing on the knowledge as they shall also be responsible for shaping up their mentee's one day.

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Original article

A comparative study on the efficacy of topical voriconazole and topical natamycin in mycotic corneal ulcer; which to choose - natamycin or voriconazole?

Dimple Deori, Paramesh Bharali

Abstract

Background : Mycotic corneal ulcer or fungal corneal ulcer is considered to be one of the major causes of ocular morbidity in developing countries like India. Fungal corneal ulcer is notoriously challenging to diagnosis and difficult to treat. Timely diagnosis, administration of appropriate antifungal agents and its ability to penetrate aqueous and achieve therapeutic levels required for effective management of fungal corneal ulcer.

Aims and Objectives : To evaluate the efficacy of topical Voriconazole (1%) and topical Natamycin (5%) ophthalmic suspension in the treatment of mycotic corneal ulcer and its comparison.

Materials and Methods: The study was carried out in the Department of Ophthalmology, Assam Medical College and Hospital, Dibrugarh, Assam from January 2021 to January 2022.The present study included 40 patients of fungal corneal ulcer who were randomized to receive topical Voriconazole (1%) and topical Natamycin (5%).The mean size of corneal ulcer, depth of infiltrate and visual acuity were comparable in both groups.

Results : The improvement in signs like size of corneal ulcer, depth of infiltrate and visual acuity was 57%,76%,1.8logMAR in Voriconazole group and 52%,63%,1.7 logMAR in Natamycin group. At 1 week follow up.

Conclusion : Topical Voriconazole (1%) was found to be safe and effective drug in primary management fungal corneal ulcer and its efficacy is matching with conventional topical Natamycin (5%).There was no added advantage of using topical Voriconazole (1%) over topical Natamycin (5%) in primary fungal corneal ulcer treatment and can be used in case of failure of conventional therapy as a reserved drug. The study showed the efficacy of both topical Voriconazole and topical Natamycin in treating fungal corneal ulcer with topical Voriconazole doing slightly better results in the study population.

Key Words : Mycotic corneal ulcer, Voriconazole, Natamycin.

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INTRODUCTION

Fungal keratitis remains a challenging and often elusive diagnosis in endemic tropical and sub-tropical regions. Delays in diagnosis leads to the sequelae of corneal fungal infections irreversible.[1] In India, fungal corneal ulcer is common due to tropical climate and large agricultural population.[2] Infection with fungal keratitis can be _____more virulent and damaging and moredifficult to treat than bacterial origin.[3] Ocular trauma with vegetative matter is a major predisposing factor for fungal keratitis in developing countries like India. It is also associated with the use of corticosteroids, immunosuppressant, chemotherapeutic drugs.[2] As fungi penetrate into the stromal layers of the cornea, a reactive innate, adaptive immune response occurs which leads to further tissue damage, scarring and opacification of cornea.[1] The most frequent etiological agent is filamentous fungi of Fusarium, Aspergillus, Curvularia and Bipolaris species secondly to yeasts.[4] There are multiple topical antifungal drugs for treatment but NATAMYCIN is only approved by FDA.[5] Recent emergence of topical VORICONAZOLE (second generation triazole) now presenting with a therapeutic alternative.[6]

The current study aims to compare the efficacy of topical (1%) VORICONAZOLE with (5%) NATAMYCIN E/D in the treatment of fungal corneal ulcer patients.

Materials and Methods

The Study design is Comparative, Prospective. It was carried out in the Dept. of Ophthalmology, Assam Medical College and Hospital, Dibrugarh from January 2021 to January 2022 (12 months). Sample size was 40. Patients were randomized into two groups, Group A (n=21) getting Voriconazole eye drop and Group B (n=19) getting eye drop Natamycin.

After taking informed consent a detailed history of any systemic disease, trauma, contact lens wear, and steroid use was taken. A detailed clinical examination was carried out including Visual Acuity, size of Corneal Ulcer, Stromal Infiltrate, Hypopyon and Ocular Adnexa. Intra-ocular pressure was assessed digitally. A proper Nasolacrimal duct patency was tested for every corneal ulcer patient and routine blood investigations along with Random Blood Sugar level was done.

Inclusion Criteria:

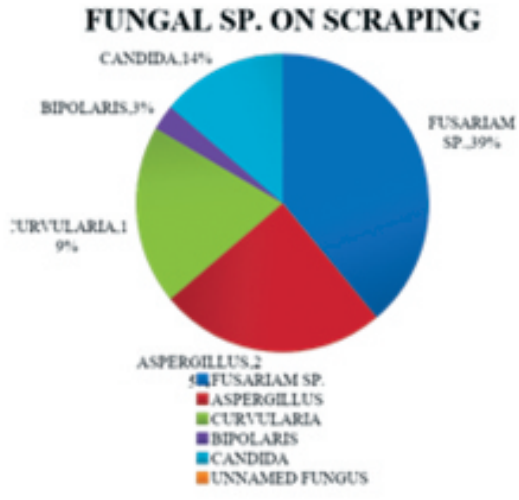
1) All corneal ulcer patients attending OPD, Dept. of Ophthalmology AMCH, with Positive fungal element in corneal scrapping.

Exclusion Criteria:

1) Impending corneal perforation with desmetocele,2) Evidence of bacteria or protozoa by stain, 3) Evidence of herpetic keratitis, 4) Corneal scar not distinguishable from current ulcer and bilateral ulcers, 5) Previous penetrating keratoplasty

Microbiological Examination

- Corneal scrapping done in every corneal ulcer patients under local anaesthesia, with a sterile



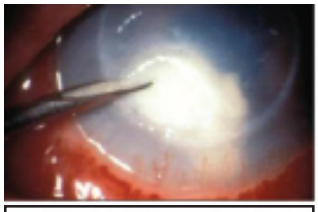
11 no. surgical blade under proper aseptic conditions.

- Scrapping was taken from base, edge of the ulcer.

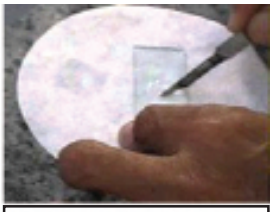
- Scraping material was sent for Gram stain, KOH mount, culture and identification in Saubouraud's Dextrose agar, Chocolate agar along with culture and sensitivity reports.
- Corneal biopsy indicated when corneal ulcers not responding to treatment.
- Other investigations includes anterior chamber tap and Polymerase chain reaction.
- 5% Natamycin topical formulation available commercially was used and topical 1% Voriconazole eye drops were prepared by reconstituting sterile lyophilized powder available as 30 mg Vials with 3 ml sterile water for injection to make 1% Voriconazole eye drop.
- The treatment was comprising 1% VORICONAZOLE in 21 cases and 5% NATAMYCIN in 19 cases. One drop of randomized medication was applied 1 hourly to the affected eye for 2 weeks while awake and then every 2 hourly while awake for another 2 weeks. The treatment regimen was strictly monitored, further dose titrated according to patient's response. The parameters including visual acuity by Snellen's chart, size of corneal ulcer and infiltrate were recorded during follow up. Standard follow up visit taken after 1,2,4,8 weeks for analysis. The efficacy of two drugs, were compared based on visual acuity by Snellen's chart, corneal ulcer size regression and infiltrate using slit lamp.

Results and Observations

Total 40 patients fulfilled the inclusion criteria was included and admitted in the ward. The following observations were made from the two groups of patients with fungal corneal ulcer treated drops Voriconazole (1%) and Natamycin (5%).



Scraping



KOH Mount

SDA Agar-aspergillus

Table–1: Age and Sex Distribution

Age Group	No.	Sex Gr	No.
1)16-30 Years	10	Male	29
2)31-45Years	17	Female	11
3) 46-60Years	12		
4) > 60	1		

Table1-Maximum numbers of cases were seen in the age group 31-45years (n=17) and least in those above 60 years (no=1) and males are affected more (n=29), compared to female (n=11); Male is to female ratio (M: F) = 2.6:1

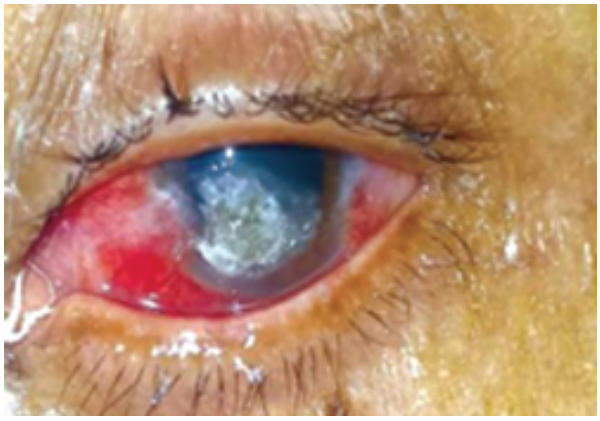


Table-2: Distribution of Occupation and Pre-Disposing factors

Occupation	Total No.	Pre-Disposing Factors	Total No
1)Farmers	16	1)Vegetative matter	18
2)Labourers	10	2)Wood	4
3)Housewives	6	3)Trauma with cement	1
4)Students	2	4)Trauma with Iron rod	3
5)Businessmen	6	5)Insect injury	10

Table 2 shows that the majority of patients were farmers (n=16) followed by labourers (n=10) who do outdoor activities, and the manner of injury was mainly by vegetative matter (n=18) followed by insect bite and others.

The grades of Corneal Ulcer size, Corneal Infiltrate and Visual acuity (VA) were compared according to the following table.

Grades of Corneal Ulcer	Grades of Corneal Infiltrate	Grades Of VA
Grade 0=< 0.5mm.	Grade 0=No Infiltrate.	Grade0=6/6.
Grade 1=<0.5-1mm	Grade1=Upto Epithelial surface.	Grade1=6/6-6/18.
Grade 2=<1-2mm.	Grade2=Dense but Superficial, limited to ulcer base.	Grade2=6/24-6/60.
Grade3=<2-5mm.	Grade3=Dense extending to mid-Stroma.	Grade3 < 6/60-3/60.
Grade4 > 5mm.	Grade4=Dense extending to deeper than mid-Stroma or Sclera.	Grade4 < 3/60.

Microbiological findings

Among the fungal species results found of scrapping are Fusariam 39%, Aspergillus 25%. Curvullaria 19% followed by Candida 14% and Bipolaris3%.

Statistical Analysis

The collected data were entered and analyzed by using the SPSS (statistical presentation system soft wear). The level of statistical significance was p value < 0.05.

Clinical signs of 40 patients were assessed on Day 0 presentation and at 1 week, 2 weeks, 4weeks, 8 weeks. Symptoms were excluded from analysis because of symptoms are much milder than clinical signs.

Table -3 (Day 0) = Corneal Ulcer (CU) Size

Gr A-Voriconazole (n=21)
Gr B-Natamycin (n=19)

	C.U.size score 0	C.U.size score 1	C.U.size score 2	C.U.size score 3	C.U.size score 4
Gr A	-	-	03/14.2%	15/71.4%	03/14.2%
Gr B	-	-	02/10.5%	13/68.4%	04/21.0%
					p=0.8242

Table 3 shows that, on the Day of 0 presentation 71.4% patients in Group A and 68.4% patients in Group B had Grade 3 size of corneal ulcer while Grade 2 size of corneal ulcer were present in 14.2% patients of

Group A and 10.5% patients of Group B. 14.2% patients in Group A and 21.0% patients in Group B had Grade 4 size of corneal ulcer and it was comparable in both the groups; p-value being 0.8242 more than 0.05.

Table -4 (1 Week) = Corneal Ulcer Size

DRUG	C.U.size score 0	C.U.size score 1	C.U.size score 2	C.U.size score 3	C.U.size score 4
Group A	-	05/23.8%	04/19.0%	12/57.1%	-
Group B	-	02/10.5%	07/36.8%	10/52.6%	-
					P value=0.3343

In Table 4, we can see, after 1 week 57.1% patients in Group A and 52.6%patients in Group B had Grade 3 size of corneal ulcer while Grade 2 size corneal ulcer s were present in 19.0% patients of Group A, 36.8% of Group B .23.8% patients of Group A and 10.5% patients of Group B had Grade 1 size of corneal ulcer and no patients had Grade 4 size of corneal ulcer .The difference was statistically not significant, p=0.3342.

Table-3 (2 Weeks) = Corneal Ulcer Size

DRUG	C.U.size score 0	C.U.size score 1	C.U.size score 2	C.U.size score 3	C.U.size score 4
Group A	-	05/23.8%	16/76.1%	-	-
Group B	-	02/10.5%	17/89.4%	-	-
					P =0.2695

Table -4,shows that at 2 weeks ,76.1% patients in Group A and 89.4%patients in Group B had Grade 2 size of corneal ulcer while Grade 1 size ulcers were present in 23.8% in Group A and 10.5% patients in Group B and NO patients had Grade 3 and Grade4 size corneal ulcer. The difference was statistically not significant, (p=0.2695).

Table -5(4 WEEKS) = CORNEAL ULCER SIZE

DRUG	C.U.size score 0	C.U.size score 1	C.U.size score 2	C.U.size score 3	C.U.size score 4
Group A-Voriconazole	12/57.1%	09/42.8%	-	-	-
Group B-Natamycin	07/36.8%	12/63.1%	-	-	-
					P =0.1991

In the present study Table 5 shows that at 4 weeks, 42.8% patients in Group A and 63.1% patients in Group B had Grade 1 size of corneal ulcer while Grade 0 size of corneal ulcer present in 57.1% patients of Group A and 36.8% patients of Group B and NO patients had Grade 2, 3, 4 size of corneal

ulcer. The difference are statistically not significant, (p=0.1991)

Table-6(8 Weeks) = Corneal Ulcer Size

DRUG	C.U.size score 0	C.U.size score 1	C.U.size score 2	C.U.size score 3	C.U.size score 4
Group A-Voriconazole	16/76.1%	05/23.8%	-	-	-
Group B-Natamycin	14/73.6%	05/26.3%	-	-	-
					P value=0.8549

In the present study, Table 6 shows that, at 8 weeks 23.8% patients in Group A and 26.3% patients in Group B had Grade 1 size of corneal ulcer while Grade 0 size of corneal ulcer were present in 76.1% in Group A and 73.6% patients in Group B .No patients had Grade 2, 3, 4 size of corneal ulcer .The difference was statistically not significant, (p=0.8549).

Table 7 = Corneal Infiltrate Score, Day 0, 1 Week, 2 Weeks

Drug	C.I.Score 0	C.I.Score 1	C.I.Score 2 (%)	C.I. Score 3 (%)	C.I.Score 4 (%)	p Value
Day 0. Group A	-	-	02/9.5	05/23.8%	14/66.6%	0.9733
Day 0. Group B	-	-	02/10.5%	05/26.3%	12/63.1%	Do
1 Week. Group A	-	-	01/4.7%	16/76.1%	04/19.0%	0.6461
1 Week. Group B	-	-	01/5.2%	12/63.1%	06/31.5%	Do
2 Weeks. Group A	-	05/23.8%	14/66.6%	02/9.5%	-	0.3586
2 Weeks. Group B	-	03/15.7%	11/57.8%	05/26.3%	-	Do

Day 0, the above Table 7 shows, presentation of corneal infiltrate score 66.6% patients in Group A and 63.1% patients in Group B had Grade 4 size of corneal infiltrate while Grade 3 size of corneal infiltrate were present in the 23.8% in Group A and 26.3% patients of Group B. 9.5% patients in Group A and 10.5 patients in Group B had Grade 2 size of corneal infiltrate and it was comparable in both the groups (p value=0.9733).

In the 1st week presentation of corneal infiltrate shows that 19.0% patients in Group A and 31.55 patients in Group B had Grade 4 size of corneal infiltrate while Grade 3 size of corneal infiltrate were present in the 76.1% patients of Group A and 63.1% patients in Group B .4.7% patients of Group A and 5.2% patients of Group B had Grade 2 size of corneal infiltrate .The difference was statistically not significant (p=0.6461).

In the 2nd week, presentation in Table 6 shows that, 9.5% patients in Group A and 26.3% patients in Group B had Grade 3 size of corneal infiltrate while Grade 2 size of corneal infiltrate were present in 66.6% patients of Group A and 57.8% patients of group B.23.8% patients of Group A and 15.7% patients in Group B had Grade 1 size of corneal infiltrate. The difference was statistically not significant (p=0.3586).

Table -8 (At 4, 8 Weeks) = Corneal Infiltrate Score, 4 and 8 Weeks

Drug	C.I.Score 0 (%)	C.I. Score 1	C.I.Score 2	C.I.Score 3	C.I. Score 4	P Value
4 Weeks Group A-Voriconazole	07/33.3	12/57.1%	02/9.5%	-	-	0.7672
4 Weeks GroupB-Natamycin	07/36.8	09/47.3%	03/15.7%	-	-	do
8 Weeks Group A-Voriconazole	12/57.1	09/42.8%	-	-	-	0.4154
8 Weeks Group B-Natamycin	08/42.1	10/52.6%	01/5.2%	-	-	do

Table -8shows that, at 4 weeks 9.5% patients in Group A and 15.7% patients in Group B had Grade 2 size of corneal infiltrate while Grade 1 size of corneal infiltrate presents in 57.1% in patients of Group A and 47.3% patients of Group B .33.3% patients in Group A and 36.8% patients in Group B had Grade0 size of corneal infiltrate. The difference was statistically not significant (p=0.7672).

Table -8, also shows that ,at 8 weeks Grade 1 size of corneal infiltrate were present in 42.8% patients of Group A and 52.6% patients of Group B.57.1% patients of Group A and 42.1% patients in Group B had Grade 0 size corneal infiltrate .The difference was not statistically significant(p=0.4154).

Complete epithelization of the fungal corneal ulcer seen at 8 weeks periods. No patient was lost to follow up as every patients was admitted and co-operative. No patient developed perforations. No diabetic or immunocompromised patients were included.

Table: 9(Graph) —Corneal Ulcer Score at 8 Weeks—

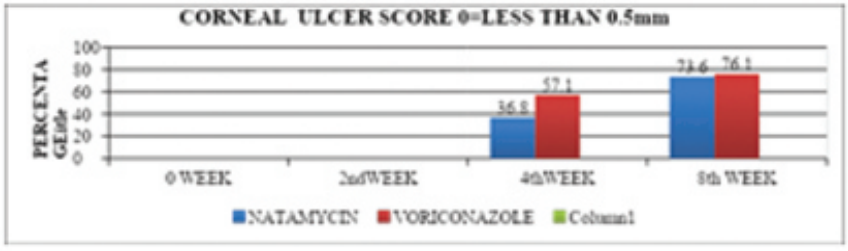
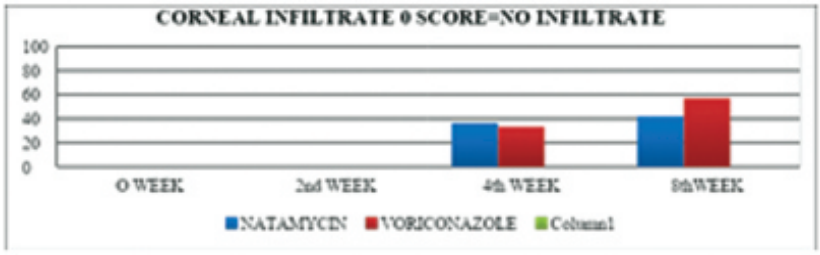


TABLE 9- (Graph) shows that , at the 8 weeks of continuous treatment , Voriconazole (76.1%) group did a fairly good results than Natamycin(73.6%) group by decreasing corneal ulcer size less than 0.5mm and almost complete healing occurred at 8 weeks.

Table: 10—Corneal Infiltrate Score At 8 Weeks—



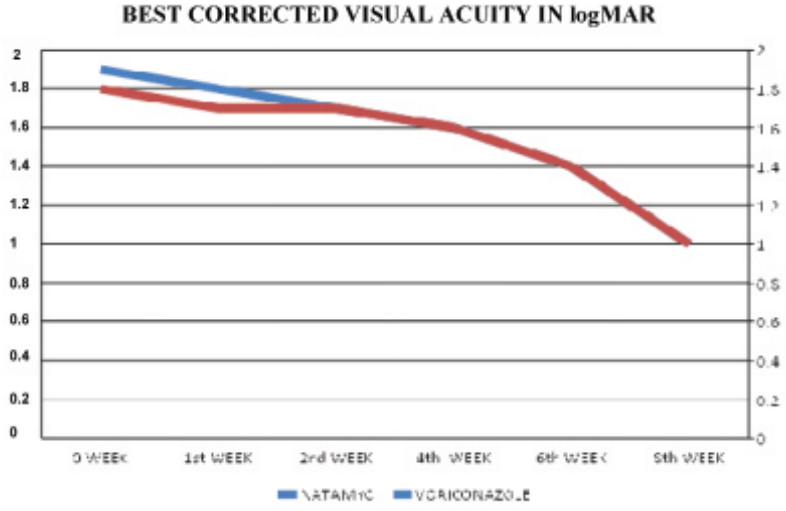
The above Table 10-(Graph), shows that no infiltrate at 8 weeks of continuous treatment with antifungal drugs indicating complete healing with Voriconazole (57.1%) group having fairly good results almost comparable to Natamycin(42.1%) group at 8 weeks.

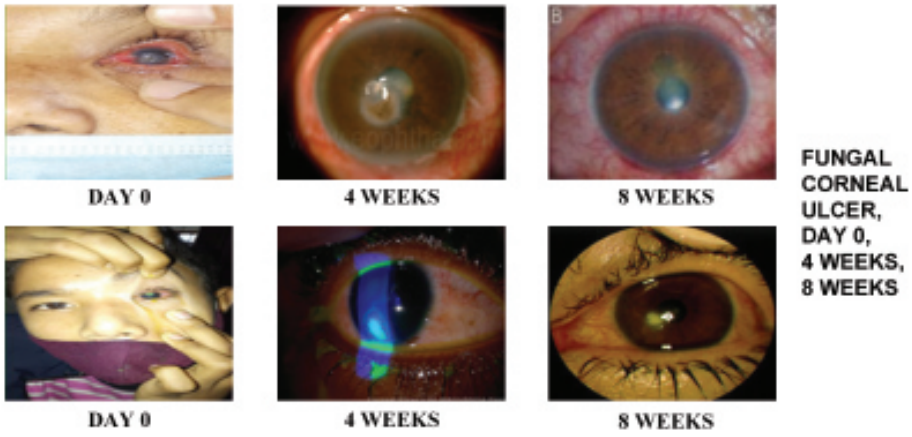
Table: 11= height of hypopyon at 4 weeks.

Groups	At Presentation	At 1 Week	At 2 Weeks	At 4 Weeks
Voriconazole	1.8mm	1.1mm	0.6mm	0.15mm
Natamycin	1.6mm	0.9mm	0.4mm	0.1mm

Table 11-shows that , height of Hypopyon decreased at 4 weeks period to almost complete resolution since the date of presentation in ten numbers of Voriconazole groups and nine numbers of Natamycin groups and Natamycin group did slightly better results than Voriconazole groups.

Table 12 =graph – best corrected visual acuity (logMAR)





FUNGAL CORNEAL ULCER, DAY 0, 4 WEEKS, 8 WEEKS

Table 12-shows improvement of visual acuity in terms of logMARchart at 8 weeks and both the Natamycin and Voriconazole groups almost did the similar results of improvement.

Discussion

The study had male preponderance (M:F=2.6:1) in accordance with the study of Nath et.al[7] and maximum in 31-45 years of age group which is similar with the study of Chowdhury et.al[8] who also reported maximum numbers(37%) of cases in in 31-40 years of age group. In this study more numbers of fungal corneal ulcer found (n=16) in farmers or rural agricultural workers which is also similar to the study of Bharathi et.al (farmers=64.75%)[9] Trauma with vegetative matter has been associated with maximum numbers (n=18) of mycotic corneal ulcer in the present study which is also similar to the study of Bharathi et.al.[9] Here 18 cases out of 40 had h/o trauma with vegetative matter to the eye, carries a significant risk of intra-ocular involvement. NATAMYCIN(5%)had been an very efficient FDA approved drug but the newer drug Voriconazole(1%)has also been reported as a highly potent tri azole with 100% in vitro susceptibility against fungal pathogens compared with only 60-84% for Fluconazole, Itraconazole, Amphotericin B and Ketoconazole.[10] On comparing the efficacy of topical (1%) Voriconazole with (5%) Natamycin, improvement in signs like size of corneal ulcer, depth of infiltrate and visual acuity was almost similar at 4 week and 8 weeks follow up .Eye drop VORICONAZOLE (1%) was found slightly better result. In this study p value is more than 0.05%, statistically not significant. Almost complete epithelization, resolving hypopyon and improvement of best corrected visual acuity to logMAR1 (Snellen's chart=6/60) seen in both the groups at the end of 8 weeks. No cases of any perforations seen, patients were co-operative and admitted and there was no one lost to follow up.

Similarly in 2011, Ritu Arora et al.[11] Reported that improvement in signs like size of corneal ulcer ,depth of infiltrate and visual acuity was statistically not significant.(P value more than 0.05% seen). Same was reported in 2016, Ishank Gupta, V. K. Malik[12] randomised two groups of 25 patients received 1% VORICONAZOLE and 5% NATAMYCIN and observed improvement in signs like size of corneal ulcer, depth of infiltrate and visual acuity was statistically not significant (p=0.94).

Conclusion

Aspergillus and Fusarium species are more common fungal species in our North-Eastern part of INDIA. Topical (1%) VORICONAZOLE was found to be safe and effective drug in primary management of fungal keratitis and efficacy is matching with conventional topical 5% Natamycin. There was no extra advantage of using topical1% Voriconazoleover 5% Natamycin as primary treatment in fungal keratitis but can be used as a reserve drug in case of failure of conventional therapy. Hence, the results of our study shows that, both drugs are efficient in the treatment of fungal keratitis but (1%) VORICONAZOLE did fairly good results compared to (5%) NATAMYCIN, may be due to species related response in our North-Eastern regions of India.

Limitations of the study

- Large sample size, subsequent follow up and long term study were essential to assess clinical significance of treatment responses.
- Elderly, rural, low socio-economic patients and advanced disease might hinder the clinical assessment of the study population.
- Source of financial support–none.
- Conflict of interest–none.

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Invited article

Vision in Aviation
"A pilot's Eyes are his Finest Weapons"

Dev Kamal Kagti

Introduction

Flying is a complex task comprising of integration signals from various neural inputs; to name a few the visual, vestibular and auditory into meaningful psychomotor tasks which leads to successful navigation of the aircraft flown by the individual. Amongst the inputs received; the most important being those from the visual system, be it in Visual Flying or Instrument Flying. The importance of vision in pilots/ aviators in very important in military as well as civil flying. There are a number of conditions which are encountered during flying which is not seen in normal terrestrial life. The majority of skills required for flying starts from attaining the correct visual stimulus. Hence, selecting those candidates with an optimal visual system is of utmost importance.

The Visual Loop

The various factors involved in presenting of meaningful image during flying is presented in the schematic diagram below.

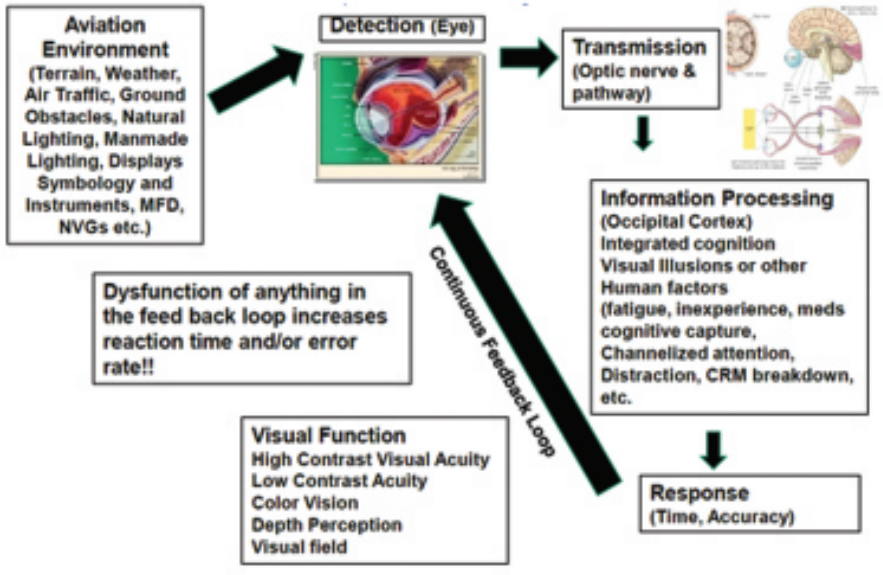

Fig-1: Vision in Aviation

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Visual Conditions Encountered During Flying

There are a number of conditions which are peculiar to flying which are faced regularly by the aviators. Few of the problems are discussed below:-

Latency of Reaction Time. It is the time taken to respond (typically via a button press) to the sudden appearance or change of a visual stimulus which is 180-200 milli sec. However, in flying reaction time is more complex. The figures below gives the distance travelled by an aircraft flying at 600miles/hr taking into account the reaction time.

Event	Reaction time	Distance covered at 600 miles/hr
Seeing an object	0.1 s	88 ft
Obtaining a clear picture	0.3958s	348 ft
Min recognition time	1.045s	920 ft
Decision time	3.045s	2680 ft
Action to avoid a collision	5.445s	4792 ft

Blind Flying. At high speed pilot flies 'blind' for thousands of feet while performing simple operations or shifting of gaze from external to instrument panel involves convergence of the visual axes, accommodation of lens to focus and return of gaze to external environment. This complete cycles takes 2.39 sec. During this period pilot in not in visual contact with external environment. Hence, at a speed of 600 miles/hr, travels would have travelled adistance of 2104 ft, which at times could have resulted in catastrophic mishap.

Acceleration Stress. Pilot subjected to different axes acceleration stress during flying. The + Gz acceleration experienced during radial acceleration is notorious for causing various visual disturbances, namely tunneling of vision, grey out and black out which occurs as a consequence of varying degrees of inertial centrifugal forces which results in compromise of cerebral blood flow.

Blurred Zone. This is a phenomenon experienced during low level, high speed flying. On either side of the aircraft, there is blurring of images due to angular velocity of passing things on the ground relative to the speed of the aircraft. In dynamic condition i.e. if the object on ground moves at an angular velocity of 30 deg/s the acuity of vision falls to 6/12 and beyond 55 deg/s the object appear blur. Blurred zone is directly proportional to the speed & inversely to the altitude of the aircraft.

Reversal of light phenomenon and glare. Atmosphere appears bright due to scattering of light by particles. Hence, at lower altitude the air is denser thus looks brighter. As altitude increases density of air thins out which makes the atmosphere look darker. For a pilot flying at altitude 40,000ft and above, the atmosphere below looks brighter than the atmosphere above. Thus, when the pilot flying athigh altitude looks down, it appears as if light is coming from bellow. This may erroneously beinterpreted by a disoriented pilot as inverted flying.

Glare. As mentioned in reversal of light phenomenon, a pilot flying at high altitude experiences intense brightness from below due to scattering of light which is very disturbing and this can cause difficulties in dark adaptation during twilight and during transcontinental flying. To mitigate this effect pilots should avoid light coming from lower altitudes by using antiglare goggles while flying at high altitude.

Empty Field Myopia. It is an apparent state of short-sightedness, typically occurs at high altitude, when nothing is there to focus. This phenomenon can occur during night or day flying. It sets in within 2-3 sec of viewing an empty field. The eyes are unable to relax, so ciliary muscle contracts, thus increasing the power of the lens to 0.75 to 1.75 D. Night myopia similar to Empty Field Myopia but occurs at darkness during night flying. This condition can be prevented by relaxing the accommodation by focusing one's gaze at an object less than 6m away.

Dry Eye and Computer Vision Syndrome (CVS). These two conditions are very troublesome and can be said to be a continuum of the cause. Prolonged work in the cockpit in not under very ergonomic conditions with respect to *symbology*, placement of displays and ambient lightning can give rise to CVS. Dry eye alone can also result from very dry cabin atmosphere due to lack of humidity in an aircraft.

Effect of Hypoxia. Certain spectrum of light sensitivity is effected by various degrees of hypoxia. However, the effect of hypoxia on vision is most pronounced on night vision. Military flying advocates use of supplemental oxygen if flying above 8000ft. The impairment of night vision due to hypoxia is as follows:-

- 4000 ft – 5%
- 6000 ft – 10%
- 8000 ft – 15%
- 10000 ft – 20 %

Effect of Decompression Sickness. To prevent the effect of hypoxia almost all civil and military aircraft use either use of supplemental oxygen or cabin pressurization or a combination of both. In the event of sudden/ rapid decompression of the aircraft cabin due to compromise in structural integrity or pressurization mechanism the immediate effect is misting and fogging of spectacles, helmet visors etc degrading vision. Next, individuals on board are prone to develop De-Compression Sickness especially if the altitude of the aircraft crosses 22,000ft. Eyes get affected due to arterial gas embolism of cerebral blood vessels. Cerebral emboli can produce migraine like symptoms with scintillating scotoma which are often hemianopic in type and vision is reduced.

Vibrations. Vibrations of the amplitude of 2-8 Hz reduces the vision due to the movement of the eyes. Vibrations of amplitude of 25-40 Hz causes severe fatigue of ocular muscles and 50-55 Hz produces significant amount of fatigue. Problems are encountered due to disproportionate vibration of eyes & instrument panel which is compounded to result in grossly compromised vision. Effects of vibration on vision is more severe in Helicopters.

Eye Injuries. Vision can be effected by various types of eye injuries which may occur due to fragmentation of canopy or prespecs/ windscreen of aircraft due to bird hit, damage by enemy action. Also, eyes may suffer wind blast injury in the form of ecchymosis of conjunctiva, sub conjunctival haemorrhage etc during ejection.

Illusions. A visual illusion is a false perception of a true stimulus. However, this stimulus may be optimum or it may be degraded or inadequate. Visual illusions are very common in aviation. Another type of illusion encountered in aviation is the visuo-vestibular illusions. Both these types of illusions are very troublesome and often results in Spatial Disorientation (SD) during flying. SD is a leading cause of aircraft accidents, especially in aircraft piloted by a single pilot. Some of the visual and visuo-vestibular illusions encountered during flying are- Size Constancy, Shape Constancy, Aerial Perspective, Black Hole Approach, Autokinesis,

Surface Planes, Depth Perception, False Horizon, Lean on Sun Illusion, Flicker Vertigo, Somato gyral and Oculo gyral illusions.

Flying Medicals

Choosing the right candidate with optimal vision is of great consequence in aviation. Visual defects and systemic ophthalmic conditions are among the major causes of rejection and hence, a thorough and accurate eye examination is of great importance in selecting personnel for Military and Civil flying to prevent attrition at a later stage of flying. To qualify for pilot duties, the candidate must possess normal visual acuity and normal colour perception (CP-1 for military flying). The eyes and their Andrea should be free from any abnormality which would interfere with visual acuity and judgement. To reduce observer error and ensure maximum test/ reset reliability,

Certain examination techniques/ tests are recommended.

The examination is to be conducted encompassing the following:-

- History.
- General external examination of the eyes and their adnexae.
- Determination of visual acuity for distance and near vision (latent and manifest hypermetropia to be correctly documented).
- Examination to exclude nystagmus.
- Examination to asses colour vision (Ichihara chart and Martin Lantren Test) and Night Vision (Dala Cassa and electro retinogram if required).
- Contrast Sensitivity Testing (Whenever required).
- Visual judgement by doing ocular muscle balance tests (Cover Tests) and tests to rule out Heterophoria.
- Fundii, field (Perimetry if required) and other examinations.

To understand better the stringent selection criteria for selection of a candidate to the flying branch of the Indian Air Force, the visual requirements for initial selection are reproduced below:

VISUAL STANDARDS OFFICERS, CADETS FOR FLYING DUTIES AT INITIAL ENTRY

Sl No.	Med Cat	Branch	Maximum Limits of Refractive Error	Visual Acuity Errors	Colour Vision
1.	A1G 1	F(P) including Weapon System Operator	Hypermetropia: + 2.0D Sph Manifest Myopia: Nil Retinoscopic myopia: - 0.5 in any meridian permitted Astigmatism: + 0.75D Cyl (within + 2.0 D –Max)	6/6 in one eye and 6/9 in other, correctable to 6/6 only for Hypermetropia	CP-I
2.	A1G 1	Aircrew other than F(P)	Hypermetropia: +3.5D Sph Myopia: - 2.0 D Sph Astigmatism: + 0.75D Cyl	6/24 in one eye and 6/36 in other, correctable to 6/6 and 6/9. CP	CP-I

STANDARD OF OCULAR MUSCLE BALANCE FOR FLYING DUTIES

Sl. No.	Test	Fit	Temporary Unfit	Permanently Unfit
1.	Maddox Rod Test at 6 meters	Exo-6 Prism D Eso -6 Prism D Hyper-1 prism D Hypo- 1 prism D	Exo- Greater than 6 prism D Eso- Greater than 6 prism D Hyper- Greater than 1 prism D Hypo- Greater than 1 prism D	Uniocular suppression Hyper/ Hypo more than 2 prism D
2.	Maddox Rod Test at 33 cm	Exo-16 Prism D Eso- 6 Prism D Hyper- 1 Prism D Hypo- 1 Prism D	Exo - Greater than 16 prism D Eso - Greater than 6 prism D Hyper Greater than 1 prism D Hypo Greater than 1 prism D	Uniocular suppression Hyper/ Hypo more than 2 prism D
3.	Hand held Stereoscope	All of BSV grades	Poor Fusional reserves	Absence of SMP, fusion Stereopsis
4.	Convergence	Up to 10 cm	Up to 15 cm with effort	Greater than 15 cm with effort
5.	Cover test for Distance and Near	Latentdivergence / convergence recovery rapid and complete	Compensated heterophoria/ trophia likely to improve with treatment / persisting even after treatment	Compensated heterophoria

Refractive Surgery. Candidates who have undergone Photo Refractive Keratotomy (PRK)/ Laser in-situ Keratomileusis (LASIK) may be considered fit for commissioning in the Air Force in all branches, provided, the conditions laid down in the IAP 4303 are satisfied.

VISUAL STANDARDS DIRECTOR GENERAL CIVIL AVIATION (DGCA) CLASS –I AND CLASS-II CIVIL FLYING LICENCE IN INDIA

Class-II License {valid for (i)Private Pilot's License (Aeroplane & Helicopter); (ii) Pilot's License (Microlight); (iii) Student Pilot's License (Aeroplane); (iv) Student Pilot's License (Helicopter); (v) Student Pilot's License (Glider); (vi) Student Pilot's License (Balloons); (vii) Student Pilot's License (Microlight); (viii) Flight Radio Telephone Operator's License;}		**Class-I License** {(i) Commercial Pilot's License (Aeroplane & Helicopter); (ii) Airline Transport Pilot's License (Aeroplane & Helicopter); (iii) Private Pilot's License (Aeroplane and Helicopter) where Instrument Rating (Aeroplane and Helicopter) privileges are required.}	
Distant Visual Acuity (With or Without correction)		Distant Visual Acuity (With or Without correction)	
6/12 or better	Each eye separately	6/9 or better	Each eye separately
6/9 or better	Binocular Visual acuity	6/6 or better	Binocular Visual acuity
Near Visual Acuity (With or Without correction)		Near Visual Acuity (With or Without correction)	
N-5 at 30-50 cms		N-5 at 30-50 cms	

N-14 at 100 cms	N-14 at 100 cms
Colour Vision. Determines using chromatic confusion plates or discs, colour lantern tests or anomaloscope. If a candidate fails in the Plate test, he can be subjected to lantern test or anomaloscope to certify him or her as "Colour Defective- Safe" and cleared for colour vision if he can differentiate aviation safety colours.	Colour Vision. Determines using chromatic confusion plates or discs, colour lantern tests or anomaloscope. If a candidate fails in the Plate test, he can be subjected to lantern test or anomaloscope to certify him or her as "Colour Defective- Safe" and cleared for colour vision if he can differentiate aviation safety colours.
Ocular Muscle Balance. Eyes should be well aligned and should have normal binocular vision. No manifest squint is permissible. Convergence must be adequate. Ocular movement should be full and free. Ocular muscle balance can be tested with cover test, Maddox rod or anapproved vision tester.	Ocular Muscle Balance. Eyes should be well aligned and should have normal binocular vision. No manifest squint is permissible. Convergence must be adequate. Ocular movement should be full and free. Ocular muscle balance can be tested with cover test, the Maddox rod or anapproved vision tester.
Visual Fields. Assessment of Visual Fields by confrontation is adequate. In case of doubt (congenital or acquired ptosis, corneal opacities, suspected glaucoma, retinal pathology etc), Humphrey's Automated Perimetry may be done under supervision of ophthalmologist.	Visual Fields. Assessment of Visual Fields by confrontation is adequate. In case of doubt (congenital or acquired ptosis, corneal opacities, suspected glaucoma, retinal pathology etc), Humphrey's Automated Perimetry may be done under supervision of ophthalmologist.

Conditions Disqualifying for Initial Issue of DGCA Class-I & Class-II License

The following ophthalmological conditions are disqualifying for initial medical examination for issue of civil flying license, however, if some of these conditions develops later in individuals who already has qualified for a Civil license, then some of these conditions can be granted waiver for renewal of license on a case to case basis with certain restrictions:-

- History of recurrent keratitis or corneal ulcers, corneal scars which influence visual function and Keratoconus
- Lattice degeneration of the retina and any macular degeneration that interferes with visual function
- Hereditary degenerations with progressive influence on visual acuity and visual fields (e.g. retinitis pigmentosa)
- Retinal detachment
- Vascular disorders with exudates, bleedings or ischemic retinal damage
- Optic neuritis, Optic atrophy and Optic nerve head drusen
- Central Serous Retinopathy
- Glaucoma
- Cataract surgery with intra ocular lens implant

There are certain conditions which can be granted Civil License on a case to case basis namely,

- Candidates for initial issue medical examination having corneal / congenital lenticular opacities which are non-progressive and do not interfere with vision may be considered fit for flying duties.

- Candidates for initial issue medical examination having undergone Refractive Corneal Surgery (LASIK) will be considered for Medical fitness for initial issue of license, if the visual requirements for the license category are met with normal corneal topography, no post-surgical complications like corneal opacity interfering with vision and unstable refraction. All subsequent reviews will be done at Institute of Aerospace Medicine, Bangalore / Air Force Central Medical Establishment, New Delhi.

Conclusion

The examiner as well as the candidate seeking a license for flying and as well as those who are already flying require to be indoctrinated on the medical aspects as well as operational aspects of flying to ensure safe flying operations. In short, *what the mind does not know, the eyes may not see*.

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Invited article

Prevention of Diabetic Retinopathy Blindness-Current Strategy

Satyen Deka

Diabetes Mellitus is now a global epidemic. India is reported to have the second-highest number of people with diabetes in the world following China.[1,2] In 2019; 77, 005, 600 people were estimated to have diabetes in India.[1] The prevalence of diabetes in India varies widely ranging from 5% to 16% at present.[4] Undiagnosed diabetes is a significant problem in India.[3] It will progress towards a higher prevalence of diabetes and so each state should prioritize diabetes care urgently.[3]

Diabetic Retinopathy (DR) is an emerging preventable cause of blindness in India. All patients with Diabetes should be Screened Regularly for Sight-threatening Diabetic Retinopathy (STDR).The purpose of DR screening is to identify people with sight-threatening DR (STDR) so that they are treated promptly to prevent blindness. Diabetic Retinopathy (DR) is the most common microvascular ocular complication of diabetes. Sight-threatening DR (STDR), which includes proliferative diabetic retinopathy (PDR) and/ or diabetic macular edema (DME) are common causes of visual impairment in people with diabetes.

While individuals with no DR and mild non-proliferative diabetic retinopathy (NPDR) are considered non-referable, referable DR is defined as the grade of severity of DR more than mild NPDR (moderate NPDR and above with or without DME). Unlike reports from the Western countries that show that the prevalence of DR is about 30% in people with diabetes, population-based studies in India over the last two decades report a lower prevalence -of DR of approximately 18% in urban areas and 10% in rural areas.[4-12] This is despite known risk factors associated with DR such as uncontrolled hyperglycemia, hypertension, and dyslipidemia being highly prevalent in India. There are possibly inherent genetic and local environmental protective factors for DR that are yet to be elucidated. Longer duration of diabetes carries the highest risk. However, approximately 5%–10% of people have STDR, highlighting the importance of DR screening.

For ophthalmologists, it is essential to ensure

- Timely detection of STDR.
- Appropriate and prompt treatment as per standard protocol
- Education of individuals with diabetes regarding their eye status
- Referral to physicians for control of the risk factors and other associated complications of diabetes.

Identification of People with Diabetes for DR Screening

There is a high prevalence of undiagnosed diabetes in India and so screening for DR cannot be restricted to people with known diabetes. It is recommended that DRscreening be done for all people with known diabetes on treatment, a single record of random

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blood sugar (RBS) of e”200mg/dl (e”11.1 mmol/l), glycated hemoglobin (HbA1C) >6.5% (48 mmol/l) or higher or gestational diabetes when first notified to a medical personnel. If facilities are not available for screening, referral to a center with DR screening facilities should be made and documented. Although at least two laboratory test results are required to prove that an individual has diabetes, we recommend that at least a single laboratory test be performed to screen for diabetes due to the urgent need to identify and treat patients with STDR to prevent blindness due to diabetes.

The Government of India has introduced non-communicable disease registers (NCD registers). People with diabetes are registered in these NCD registers and should be screened regularly for DR. The DR status should be recorded for each patient to enable regular monitoring and for audit purposes.

Patients visiting ophthalmologists for cataract surgery or any other surgical procedures should have at least one RBS test done. If the RBS is e”200 mg/dl (e”11.1 mmol/l) or Hba1c is > 6.5%, a dilated fundus examination and status of DR should be recorded before surgery. If there is no fundus view due to dense cataract, B-scan should be performed to rule out vitreous hemorrhage (VH) or retinal detachment prior to surgery. Fundus examination for assessment of DR should be performed during the immediate post-operative review.

In camps or community screening conducted by physicians or ophthalmologists, the same recommendations have to be followed. Pharmacies/ medical shops and laboratories are important sources for screening for diabetes. Patient information sheets on diabetes and its complications and need for DR screening can be developed and supplied to these local sources to increase public awareness of DR.

Each medical institution should be encouraged to maintain a diabetes registry with data on grade of DR to ensure patients can be re-called for DR screening. Robust data collection enables accurate reporting of the prevalence and incidence of STDR. This strengthening of data collection will help drive public health initiatives and blindness control programs to reduce visual impairment in people with diabetes.

DR Screening Intervals

Sankara-Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study (SN_DREAMS II) reported that the 4-year incidence of DR, DME, and STDR as 9.2%, 2.6%, and 5.0%, respectively. In subjects with DR at baseline, the incidence of DME and STDR increased to 11.5% and 22.7%, respectively.[5]

Risk Factors Pre-existing DR is, therefore an important risk factor for progression. Strong association of DR progression was also observed with longer duration of diabetes, age above 40 years, Higher systolic blood pressure, High HbA1C, Anemia, High serum cholesterol, Obesity, Low-fiber diet, Albuminuria, Neuropathy and foot ulcerations.[13-18] Annual screening for DR is recommended for all diabetic population. Patient information sheets should be developed and given to each patient with DR. The information should contain the recommended individualized frequency of screening, explanation that STDR may occur before a patient becomes symptomatic, risk factors for progression of DR and associations of DR with other complications of diabetes.

Screening Models: The gold standard for grading the severity of DR is stereoscopic fundus photography through dilated pupils, using seven standard fields, and grading guidelines for these photographs established by the Early Treatment Diabetic Retinopathy Study (ETDRS) group.[19] However, in a country such as India where there are insufficient ophthalmology services to cater to the needs of the population, a step by step approach is required. These steps include mass population based screening for DR to improve awareness of this ocular complications among patients, public, and health care personnel. More specialized services are

required for those with DR to enable close monitoring and treatment. Several population-based screening and awareness programs have been conducted across the nation. Very few meet the gold standard of DR screening. However, India is at a point where it is crucial to identify every patient with STDR. So, there is a need to strike a balance between gold standard and acceptable screening protocol for the large population. Telemedicine and the use of non-mydriatic fundus camera are major steps in the set-up of DR screening.[20] However, small pupils and cataract degrade the image quality taken in undilated conditions.[21]

It is therefore, encouraged that mydriatic screening for DR becomes routine practice and all ophthalmology departments should aim to work towards providing a mydriatic DR screening service unless non-mydriatic wide-angled cameras are used.[22] Screening for DR can be through community-based screening models or hospital-based screening models.

Community-based screening models:

Community Outreach is an extended service of the provider hospital. The main aim of community outreach includes reaching out to the people with diabetes at their doorsteps for DR screening and to involve the community (voluntary organizations and primary care physicians) in DR awareness creation. These outreach clinics may be targeted only for people with diabetes or general population screening for diabetes followed by DR screening. Exclusive DR camps should include diabetologists (or general medical practitioners) and ophthalmologists and paramedical personnel with sufficient equipment to screen, diagnose and refer people who require treatment to attend specialized ophthalmology care delivery centers for treatment. The screening camps for detecting diabetes followed by DR screening needs specific publicity campaigns and separate infrastructure. Screening for diabetes and DR is done simultaneously. Screening for diabetes is usually accomplished through estimation of RBS (finger prick sample). However, the yield of STDR using this method is less and is less cost-effective than screening people with known diabetes for DR.

Opportunistic DR screening in diabetes clinics/ general physician clinics/pharmacy and/or medical laboratories: The point of contact and care for a person with diabetes is usually a physician/ diabetologist, the pharmacy, or the laboratory and seldom an ophthalmologist. Screening for DR in clinics or pharmacies is best achieved by tele-screening. A technician captures the retinal photographs and sends the images to the ophthalmologist for a remote diagnosis. This screening pathway needs a robust information technology (IT) enabled service delivery model consisting of ophthalmic diagnostic equipment, trained technician and internet connectivity in a diabetes center and an ophthalmology center to effectively screen for DR. Thus, patients would receive remote expert ophthalmologist consultation without having to visit an eye hospital.

Screening in Primary Health Centres (PHCs): This involves either the primary health centers (PHCs) being self-sufficient to provide this service such as in Kerala or establishing a "Public Private Partnership" for DR screening. In this regard, the district health authority has to give permission to an external eye care provider. Trained ophthalmic technicians perform fundus imaging to screen all the registered diabetes patients at the PHCs. Screening for DR at PHCs may be done on a specific day in a week. Mydriatic DR screening is recommended.

Detecting DR in Vision Centres (Primary Eye Care Centres): The core objective of Vision Centres is to provide comprehensive eye care by integrating IT effectively to provide quality eye care at the doorsteps of the rural population. Primary health center (PHC) with an associated vision center has a dedicated Para-medical Ophthalmic Assistant (PMOA). This set-up also called as Primary eye care center. The fundus images of patients with

diabetes can be taken by the PMOA with the help of low-cost fundus cameras after mydriasis and the images are sent to the base hospital for opinion. This enables patients examined at the vision center to have tele-consultation with an ophthalmologist at the base hospital. Patients requiring further management are referred to the base hospital.

Mobile van approach in DR screening: To reach the unreachable and increase compliance, mobile van with suitable infrastructure should be used. For the patient, this approach helps reduce travel cost and saves time. Mydriatic DR screening is recommended.

Hospital-based screening models

DR screening can be done in multi-specialty hospitals as well as tertiary eye care centers where vitreo-retinal services are available to provide the expertise and treatment. All people coming to the hospital can be referred to the retina department where the retinal images are captured after mydriasis and a retinal specialist is available for further or early management of STDR. However, the limited number of trained retina specialists and eye hospitals is a barrier for the wide implementation of hospital-based screening models.

Dynamic Referral Pathways with Feedback Mechanisms

An appropriate and accountable referral mechanism is integral to the screening program, to ensure a continuum of care, at the specialized eye hospitals for the management of DR. Referral consultations between physicians and ophthalmologists, are not optimal, indicative of lack of coordination and communication. There is no mechanism to track compliance to referral, rendering the physicians and ophthalmologists unaware of the outcomes of their referrals.[23] The inter-referral process has to be dynamic and provide feedback to both groups of professionals. Electronic medical records (EMR) or electronic diabetes registry should allow all patient records to be shared across the two professional groups and this needs to be established for a successful DR screening program.

Clinical Standards of Care for Screening and Management of DR in Hospitals

- Comprehensive eye examination includes
  - Visual acuity,
  - Measurement of intraocular pressure,
  - Slit-lamp examination of the anterior segment
  - Dilated fundus examination by indirect ophthalmoscopy and slit-lamp biomicroscopy
  - Colour Fundus Photography
- People with type 1 diabetes should have an initial dilated comprehensive eye examination by an ophthalmologist within 5 years after the onset of diabetes and annually thereafter.24
- People with type 2 diabetes should have an initial dilated comprehensive eye examination by an ophthalmologist at the time of diagnosis of diabetes and annually thereafter.[24]
- Women who develop gestational diabetes do not require an eye examination during pregnancy and do not appear to be at increased risk for developing diabetic retinopathy during pregnancy. Women with pre-existing type 1 or type 2 diabetes who are planning a pregnancy or who are pregnant should be counseled on the risk of development and/or progression of DR during pregnancy. Eye examinations prior to conception and in the first trimester and then monitoring every trimester and 6 weeks postpartum as indicated by the degree of retinopathy and as advised by the ophthalmologist. The recommended follow-up is every 3-12 months for no retinopathy or moderate non proliferative diabetic retinopathy (NPDR), or every 1-3 months for severe NPDR.[24]

Table 1 provides the screening and follow-up guidelines of people with varying severity of DR and the management. Prompt referral of people with any level of DME, severe NPDR, and PDR to an ophthalmologist/retina specialist who is experienced in the management of STDR is essential.

Table 1: Screening, management, and follow up guidelines by status of DR

Status of retinopathy	Referralto ophthalmologist	Follow-up	Recommended ocular treatment
No Diabetic Retinopathy	Within 1 year	Every1-2 years	None
Mild NPDR (Non-Proliferative DR)	Within 1 year	Every year	None
Moderate NPDR	Within 3-6 months	Every 3 months	None
Severe NPDR	Immediate	Every 3 months	Can consider pan-retinal photo-coagulation (PRP) under specific circumstances
Proliferative DR	Immediate	Every 3 months	Panretinal photocoagulation (PRP) and/or intravitreal anti-VEGF* therapy, especially if HRCs† are present
No Diabetic macular edema (DME)	Within 1 year	Every year	None
Non-CiDME (non-center involving DME)	Immediate	Every 3 months	Focal laser photocoagulation, and observe carefully forprogression to CiDME
Centre involving DME (CiDME)	Immediate	Every 1-2 months	Anti-VEGF as first-line therapy. Consider focal macular laser as a rescue therapy in eyes with persistent CiDME despite anti-VEGF. Intravitreal steroids can be used as an alternative in pseudophakic eyes or in select cases if anti-VEGF is contraindicated (like recent MI or CVA)
*VEGF- Vascular Endothelial Growth Factor. †HRC-High Risk Characteristics			

Standard of Care for Management of Diabetic Retinopathy

- Fundus fluorescein angiography (FFA) is indicated at baseline in the management of STDR to identify areas of leak in DME, ischemia (in the macula), areas of non perfusion and subtle neovascularisation.
- Optical Coherence Tomography (OCT) has become indispensable in the management of DME. At baseline for qualitative and quantitative assessment (to identify center involving DME [CiDME]) and also during follow up after treatment (intravitreal injections).
- Intravitreal injections of anti vascular endothelial growth factor (VEGF) agents are indicated as the first line therapy for central involving DME (CiDME).[30]All three drugs: ranibizumab, bevacizumab, aflibercept, brolicizumab and are effective at improving vision over 1 and 2 years of treatment for DME.[31]Currently the role of focal laser/grid photocoagulation is for the management of non center involving DME and also can be considered in partial/ non responding DME to anti VEGF injections.
- Although first-line therapy for most eyes with central-involved DME consists of anti VEGF, intravitreal injection of steroids (Triamcinolone injection/dexamethasone implant) can also be effective for DME treatment especially in pseudophakic eyes or if there is any contraindication to use of anti VEGF like any recent stroke/ myocardial infarction.[32]

- The standard doses for the conventional pharmacotherapies are:
  Ranibizumab (Lucentis/Accentrix/ Razumab/ Ranizural) 0.5 mg/0.05 ml;
  - Aflibercept (Eylea)-2mg/0.05 ml;- Brolicuizumab (Paganex) 0.5ml- Bevacizumab (Avastin off label) - 1.25 mg/0.05ml;
  -TriamcinoloneAcetanoid 2mg/0.05 ml
  - Ozurdex (dexamethasone implant) 0.7 mg.
- The panretinal laser photocoagulation (PRP) therapy is the mainstay of treatment to reduce the risk of vision loss in patients with high risk Proliferative Diabetic Retinopathy (PDR) and, indicated in some with severe Non Proliferative Diabetic Retinopathy (NPDR) (in scenario like poor compliance with follow up, impending cataract surgery or pregnancy and status of fellow eye/precious eye, etc).
- Intravitreal injection of the Anti VEGF can be combined with traditional PRP in cases with both macular edema and PDR.[33]Though there is evidence of effectiveness of anti VEGF agents for PDR without DME, the task force does not recommend the use of anti VEGF alone for PDR.
- The presence of DR is not a contraindication to aspirin therapy for cardioprotection, as aspirin does not increase the risk of pre retinal or vitreous hemorrhage.
- Topical Non-steroidal anti-inflammatory eye drops like Nepafenac eye drops have no meaningful effect in the treatment of non central DME (OCT measured retinal thickness).[34]
- For all people, regardless of the stage or severity of DR, medical management to optimize glycemic control, optimize blood pressure and serum lipid levels reduces the risk or slows the progression of diabetic retinopathy.[35]

Governance and Quality Assurance

Given the need for early diagnosis, the opportunistic diagnosis of DR during routine eye examination is insufficient to handle this major burden. Many countries have adopted systematic screening programs to screen their populations with diabetes to reduce the number of people developing blindness due to DR. Systematic screening of the diabetic population has been shown to greatly reduce the prevalence and incidence of blindness within the population.[25,26] The AIOS recommends that even though a licensed eye care professional may not be available at the site of DR screening, it becomes the responsibility of an ophthalmologist with expertise in evaluation of DR to monitor the overall tele-screening program, image interpretation, providing knowledge and skills to image readers and consultation for needy patients. It is important to ensure that those screened and identified with STDR undergo prompt management. A future systematic nation-wide program to prevent visual loss due to DR will impact all components of the health system in India. This would include the governance and leadership, the health workforce (physicians/ ophthalmologists/optometrists/nurses), the health management information systems, technology and infrastructure, and health economics, all of which need to be sensitized, adapted and enhanced to deliver screening and management services to people with diabetes. Health management information systems will need to be adapted to monitor the nation-wide program. Programs in India such as the Ayushman Bharat provide opportunities for health financing by reimbursement of costs for treatment, although an initial capital outlay for infrastructure and equipment will be required.

Education and Training

Any health care professional who has been trained suitably can screen for DR. It can be ophthalmologists, optometrists, ophthalmic assistants, trained eye technicians NCD nurses or physicians. However, the screening initiative must have an ophthalmologist who plays a pivotal role and takes the overall responsibility of the program. It is

important to ensure that all staff involved in fundus photography and grading and other aspects in the delivery of the DR program are appropriately trained, competent and accredited in the use of digital fundus camera for fundus imaging, storage, and grading of images with documentation of the diagnosis and review advice. Ophthalmologists managing STDR need short-term Medical Retina training in performing indirect ophthalmoscopy/slit lamp biomicroscopy, interpretation of OCT, performing laser photocoagulation for PDR and DME and administration of intravitreal injections.

Use of Artificial Intelligence

Given the alarming increase in the number of people with diabetes and shortage of trained retinal specialists and graders of retinal photographs, an automated approach involving a computer-based analysis of the fundus images would reduce the burden of the health systems in DR screening. In the recent past, there has been an increasing interest in the automated analysis algorithms that use artificial intelligence (AI)/machine learning/deep neural learning for analysis of retinal images in people with diabetes.27-28 The machine after being exposed to a lot of annotated images learns to grade DR by itself. These software can automatically analyze retinal images and provide the grade and severity of DR and referral recommendations.27-29 The short time taken,accuracy,consistency, and scalability are the major advantages that make the role of AI in DR detection appear promising.29 In the absence of a legal framework for use of AI in diabetic retinopathy screening in India, it is empirical for ophthalmologists to grade all those who are identified as referable by the AI algorithm and a subset of normal (10%) as identified by AI.

Public awareness

Public awareness is pivotal to the success of DR services. The continuous process of awareness creation should be conducted for the medical personnel, paramedical personnel, Non-Governmental Organizations (NGO's) and different partners. Information, education, andcommunication materials on diabetic retinopathy blindness should be published in pamphlets/brochures and posters in local languages conveying key messages regarding the need for an annual dilated eye examination. The educational materials about diabetes and DR should be distributed during seminars, training programs, exhibitions, and guest lectures. Posters can be displayed at Primary Health Centres, Hospitals, and Diabetic clinics. Efforts should be done to organize mega diabetic fair and exhibitions/rally, awareness campaigns, media coverage during World Diabetes Day etc.

Key Points[36]

- Diabetic Retinopathy (DR) can occur in Type 1 and Type 2 diabetes. Increasing diabetes duration increases the risk for retinopathy.
- Educate people with diabetes that early stages of DR are symptomatic and so screening for DR is essential.
- Routine, repetitive, life-long, expert, complete eye examination is essential for the fundamental ophthalmic care of all people with diabetes.
- Annual screening may be performed by tele medicine or by on site fundus photography.
- Opportunistic screening for DR may be done in the community through camps, at diabetes clinics, medical laboratories but DR registry should be maintained for annual re-call.
- Fundus photography can be performed by trained eye technicians/optometrists and grading of DR can be performed by certified trained eye technicians/optometrists/ ophthalmologists.
- Women with pre-existing diabetes who are pregnant or planning a pregnancy should be counseled regarding the risk of development and/ or progression of DR.
- If any level of DR is present at any examination including opportunistic screening, subsequent retinal assessment should be repeated at least annually or more frequently(in case of sight-threatening DR) as advised by the

ophthalmologist.

- Prompt referral of patients with diabetic macular edema (DME), severe non-proliferative DR (NPDR) or proliferative DR (PDR) to an ophthalmologist/retina specialist for further management of sight-threatening DR (STDR).
- The gold standard management of PDR is by pan-retinal laser photo coagulation and center involving DME is by intravitreal anti-VEGF agents and non-centre involving DME with focal laser therapy and regular follow-up is essential.
- Nationwide diabetes and DR registry is essential to ensure monitoring of compliance with referral and follow-up. Impact of DR screening and management on blindness can only be monitored by maintaining DR registry.
- Use Information technology to store fundus image data and application of artificial intelligence (AI) algorithms in DR detection could be way forward in tele medicine screening of DR.
- Good glycemic control and control of other systemic factors is beneficial in any stage of DR. It delays the onset and slows down the progression of DR.
- Diabetes, in general and DR, are generally life-long conditions. Regular follow-up care with a physician and an ophthalmologist is crucial for early detection of complications and benefit from timely treatment.

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Short Review article

Role of Bioptics in Refractive Surgery

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Abstract:

The complete surgical correction of higher refractive errors is often very challenging. Bioptics, which encompasses a combination of phakic intraocular lens implantation and laser corneal surgery, makes it possible to achieve this goal to a great extent. Bioptics is a sequential method of treating large and complex refractive errors, with the advantage of improving stability and predictability, maintaining a large optical zone, and preserving corneal prolate asphericity. It can be considered as the standard procedure for surgical correction of higher refractive errors which are outside the range of either laser corneal surgery or phakic intraocular lens alone, with the only disadvantage being increased costs.

Keywords: Refractive error; ICL; LASIK; Bioptics.

Introduction:

Bioptics, originally described by *Zaldivar R et al*,[1] utilizes the combination of a posterior chamber phakic intraocular lens (PC-pIOL) with excimer laser corneal ablation to split the optical correction between two planes, the corneal plane and the ciliary sulcus plane. Consequently, bioptics can treat complex and high refractive errors while maintaining a large optical zone with minimal induced spherical aberrations. As of today, the term has expanded to encompass phakic, pseudophakic, and clear lens extraction cases combined with several forms of corneal refractive procedures (LASIK, PRK, intracorneal rings, and RK).[2-8] The combination of intraocular implant and corneal curvature modification expands the scope of treatment for patients with significant refractive errors that fall outside the recommended treatment range of excimer laser refractive surgery or phakic IOLs, as well as patients with unfavorable corneal thicknesses that prevent full treatment of their refractive error.[2,6,8,9] The implant addresses most of the spherical error, while corneal surgery follows for fine-tuning, usually after 2–3months.In this article, we explorea few case scenarios where bioptics can be considered, along with a short review of the relevant literature.

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Case scenario 1:

A 25-year-old male presented to OPD for surgical correction of his refractive error. On examination, his uncorrected visual acuity (UCVA) was 1/60 in both eyes. He had been using spectacles since the age of 10 years, with no history of use of contact lenses. His refractive error was -22.50 DS/-1.0 DC @ 145° and -23.0 DS/-1.5 DC @ 75° in the right and left eye, respectively. His best corrected visual acuity (BCVA) was 6/6 in both eyes. His axial length (AL) was 31.56 mm and 31.92 mm in the right and left eye, respectively. His central corneal thickness

(CCT) was 530 microns and 536 microns in the right and left eye, respectively. His keratometry was 44.00 D/45.50 D in the right eye and 44.50 D/46.25 D in the left eye. His anterior chamber depth (ACD) was 3.3 mm and 3.4 mm in the right and left eye, respectively. His specular count was 3120 cells/mm^2 and 3250 cells/mm^2 in the right and left eye, respectively. His white-to-white (WTW) was 11.76 mm and 11.78 mm in the right and left eye, respectively. As the patient was outside the recommended treatment range for either excimer laser ablation or phakic intraocular lens, he was planned for bioptics surgery. The patient underwent implantable collamer lens (ICL, *STAAR Surgical,* Monrovia, CA) implantation in both eyes (-18DS ICL in both eyes). On 6-weeks follow-up after the first surgery, the patient was reassessed for residual refractive error, which revealed -5.50 DS/-1.25 DC @ 140° and -6.0 DS/-1.50 DC @ 80° in the right and left eye, respectively. The patient underwent laser-assisted in situ keratomileusis (LASIK) in both eyes for this residual refractive error, after 8 weeks of the first surgery. On first post-operative day after LASIK, he had UCVA of 6/6 in both eyes.

Case scenario 2:

A 28-year-old female presented to OPD for surgical correction of her refractive error. On examination, her UCVA was 2/60 in both eyes. She had been using spectacles since the age of 12 years, with no history of use of contact lenses. Her refractive error was +11.0 DS/"1.5 DC @ 110° and +11.0 DS/"1.0 DC @ 20° in the right and left eye, respectively. Her BCVA was 6/9 in both eyes. Her AL was 20.06. mm and 20.01 mm in the right and left eye, respectively. Her CCT was 560 microns and 564 microns in the right and left eye, respectively. Her keratometry was 41.00 D/41.25 D in the right eye and 40.75 D/41.75 D in the left eye. Her ACD was 3.1 mm in both eyes. Her specular count was 2880 cells/mm^2 and 2762 cells/mm^2 in the right and left eye, respectively. Her white-to-white (WTW) was 10.89 mm and 10.92 mm in the right and left eye, respectively. The patient was planned for bioptics surgery as she was outside the recommended treatment range for either excimer laser ablation or phakic intraocular lens. She underwent implantable collamer lens (ICL, *STAAR Surgical,* Monrovia, CA) implantation in both eyes (+10DS ICL in both eyes) along with surgical peripheral iridectomy. On 7-weeks follow-up after the first surgery, the patient was reassessed for residual refractive error, which revealed +1.75 DS/-1.25 DC @ 115° and +1.75 DS/ -1.0 DC @ 20° in the right and left eye, respectively. The patient underwent laser-assisted in situ keratomileusis (LASIK) in both eyes for this residual refractive error, after 9 weeks of the first surgery. On first post-operative day after LASIK, she had UCVA of 6/9 in both eyes.

Discussion:

The complete surgical correction of higher refractive errors had always remained a challenging task for ophthalmologists around the world. In 1999, *Zaldivar R et al*.,[1] analyzed the results of 67 eyes that received a posterior chamber hydrogel-collagen plate phakic IOL (STAAR Collamer Implantable Contact Lens) and also underwent a secondary laser-assisted in situ keratomileusis (LASIK) for the correction of extreme myopia. Their study concluded that combining posterior chamber phakic IOL implantation with LASIK (bioptics) is an effective and reasonably predictable method for correcting myopia from -18 D to -35 D. This was the beginning of the era of bioptics. Currently, bioptics encompasses the treatment of complex and high refractive errors by combining refractive techniques with different mechanisms of action, usually using an intraocular implant (a phakic or pseudophakic intraocular lens) followed by a corneal procedure (laser ablation, intrastromal implant).[2-8] *Pop M et al*.,[2] in 2001, in a retrospective study, analyzed the efficacy and safety of photorefractive keratectomy (PRK) or laser-

assisted in situ keratomileusis (LASIK) after clear lens extraction (CLE) with intraocular lens (IOL) implantation for hyperopia or astigmatism. Sixty-five eyes of 55 subjects had CLE with posterior chamber IOL implants for hyperopia up to 12.25 diopters (D); 31 eyes were retreated with PRK, and 34 eyes were retreated with LASIK for residual ametropias. IOL implantation for CLE, although an invasive technique, was found to yield better refractive outcomes without any significant complications after PRK or LASIK adjustment. *Zaldivar R et al.*,[3] in another study in 2002, retrospectively analyzed 281 eyes of 196 patients with posterior chamber phakic IOL implantation (ICL) and 64 pseudophakic eyes of 55 patients. All patients underwent LASIK 1 month or more after the first surgery. They demonstrated this technique to be predictable and safe. *Leccisotti A et al.*,[4] in 2005, in a prospective study, assessed the efficacy and safety of the combination of angle-supported phakic intraocular lenses (IOLs) and PRK for the correction of myopia and astigmatism in 76 eyes of 48 patients. All the patients underwent angle-supported phakic IOL implantation with surgical peripheral iridectomy, followed 2 to 3 months later by PRK to correct residual refractive error. They concluded that angle-supported phakic IOLs followed by adjustment by PRK offer good efficacy, predictability, and safety to manage large refractive myopic errors. *Srinivasan S et al.*,[5] in 2008, reported the initial experience of the use of implantable collamer lens (ICL) in the management of hyperopia after radial keratotomy (RK). Four eyes of 3 patients with secondary hyperopic shift after myopic RK underwent ICL implantation to correct the refractive error. This retrospective study showed that ICL implantation is an effective surgical option to consider in the management of hyperopia after RK. *Dvali ML et al.*,[6] in 2009, reported the safety and predictability of an alternate sequence of the bioptics procedure, in which the corneal flap was created first, followed by phakic intraocular lens or pseudophakic IOL implantation 3 days later. Laser ablation was performed to the stromal bed 3 months later. This modification of the sequence of procedures for bioptics provided safe and predictable outcomes. In 2017, *Abdelmassih Y et al.*,[7] in their case series of 16 eyes, evaluated the 6-month and 2-year safety and clinical outcomes of Visian toric ICL implantation for the treatment of residual refractive errors after sequential intracorneal ring segments (ICRS) insertion and cross-linking (CXL) in keratoconus. The ICRS and CXL procedures were performed sequentially with an interval of 4 weeks and the toric ICL implantation was performed at least 6 months after CXL. This study showed that Implantation of Visian toric ICL following sequential ICRS insertion and CXL is an effective and safe option for correcting high residual refractive error and improving visual acuity in patients with moderate to severe keratoconus in the long term. *Trivizki O et al.*,[8] in 2019, proved the efficacy of the bioptics procedure involving multifocal intraocular lens implantation followed 6 weeks later by an excimer laser surgery (LASIK) in young patients with very high hyperopic eyes who were not suitable for a single surgical procedure.

Conclusion:

To summarize, bioptics procedures are safe and effective. They can be considered as the standard procedure for surgical correction of higher refractive errors which are outside the range of either laser corneal surgery or phakic intraocular lens alone, with the only disadvantage being increased costs.

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Conflicts of Interest: None to declare.

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Short Review: Occupational health

Ishihara pseudo-isochromatic colour vision test

Pritam Dutta, Sangeeta Sarma

Background

There have been two main factors that have shaped the evolution of colour vision tests. The first was the requirement for occupational examinations to confirm proper colour vision in a variety of occupations and sectors, including electrical, textile, and train, naval, and armed services. Safety concerns in the wake of numerous accidents in the maritime and railroad sectors brought on by the incorrect interpretation of colored signals were a major factor in this. The second was to develop precise clinical tests to detect acquired colour deficits and screen for congenital colour deficiencies.[1]

Ishihara Colour vision test

The colour vision test with Ishihara Pseudo Iso Chromatic (PIC) plates that is most frequently used to identify CVD. This test was the first PIC test to be produced commercially, and it was initially published in 1906. Across the years, the test has been published in numerous editions all over the world.[2] The 38-plate version is regarded as the ideal for testing red-green colour vision [5]. The 38-plate variant has 13 pathway-designed plates and 25 numeral plates with one colour backgrounds incorporated in them.[2,3] The numeral plates are classified into the following categories: demonstration (plate number1), transformation (plate numbers 2-9), vanishing (plate numbers 10-17), hidden digit (plate numbers 18-21), and classification (plate numbers 22-25).[4].

The "gold standard" for quickly identifying congenital red-green deficits, according to numerous researches on the Ishihara test's effectiveness. Birch's research indicates that the average number of errors for all transformation and vanishing plates is approximately 16.[4] It has also discovered that the test's sensitivity and specificity for failing it if you get four or more errors are, respectively, 98.7% and 94.1%.[4] Additionally, the study also discovered that using hidden digit plates was difficult. The reason behind this is that, depending on the subject's age, some CVN participants are able to read them. It was discovered that 81.9% of protanopes and 93.4% of deuteranopes properly identified themselves according to the classification plates, while 18.1% of protanopes and 3.2% of deuteranopes were unable to see either figure. While 6.7% of protanomalous and 2.1% of deuteranomalous trichromats were unable to perceive the classification numbers, 46.6% of protanomalous and 57.2% of deuteranomalous trichromats were correctly classified.[4] However, in terms of luminance contrast, only 40% of the protanomalous and 37.5 % of the deuteranomalous trichromats were accurately identified (they could see both figures, but one was more distinct than the other).

Online version of Ishihara pseudoisochromatic Colour vision test

The online version differentiates between color-deficient and color-normal individuals to interpret the findings, reflecting the degree of the color-deficiency (weak, moderate or severe). Hoffmann

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and Menozzi used 10 patients with normal colour vision and 10 subjects with colour deficiencies to compare the conventional Ishihara test to a computer-based screening approach.[5] Results showed that the computer-based method successfully distinguished people with colour deficiencies from those without such deficiencies, despite variations between the spectral emission of the monitor and the reflected daylight using traditional Ishihara plates. But 20% of typical trichromats fail the test, according to Rodriguez-Carmona et al., raising questions about the test's applicability.[6]

Legal aspects of color vision

The normal trichromatic color vision allows an individual to differentiate and distinguish different colors as well as its shades effectively. Presence of congenital (equal degree in both the eyes) or acquired (one eye affected more than the other or unilateral) color blindness hinders the activities of daily life in varying extent and make certain job profiles unattainable despite having optimum visual acuity. Some visually demanding occupations require a minimum standard of color vision to be met for performing safety operations in work place that require color discrimination.[7] Today many newer generation color vision tests like Fransworth Munsell 100 hue test, Fransworth D-15 test, Aviation light test, Color Assessment & Diagnostic test etc and instruments like Anomaloscope have been introduced for precise detection of color blindness.[8] However, in India, the Ishihara pseudo-isochromatic chart developed in 1917 is the most widely used, with additional use of Martin lantern in armed forces are currently recommended for both military and civil aviation aspirants who are evaluated at medical centers of the Indian Air Force (IAF).[9] It has been observed about 18.15% of trichromats fail the Ishihara test, and about 1% of anomalous red (protan) and green (deutans) color deficient pass the same hence only pass or fail response to Ishihara test is indecisive.[10] Hence for occupational standard, these tests rather categorize color vision loss such as color perception (CP) ranging from CP-1 (best color vision) to CP-4 (worst).[11]

Tablebelow lists the minimum standard of color vision for various occupations in India.[12,13]

Occupation	Standard	Testing Method	Acceptable standard by occupation
Armed Forces (Army, Navy, Air Force)	Safety check	Ishihara test, Martin Lantern test	Army and Navy: CP1-Color Perception-1: Pass Martin Lantern test at 6 months Air Force CP2 - Zero errors on Ishihara test CP3 - Pass Martin Lantern test at 1.5 months/read correctly plates 22-25 on Ishihara test
Medicine (doctors, pharmacists, and health care professionals)	Safety and quality check	Ishihara, Cambridge color, Nagel Anomaloscope	No minimum standard
Engineering (Lab technology)	Safety and quality check	Ishihara, Cambridge color test. Farnsworth-Munsell 100 hue	Complete or partial color blindness, if an employee suffering from color blindness is posted or transferred into a category wherein color perception is necessary, his eyes will be reexamined for the same along with examination of visual acuity
Railways	Safety check	Ishihara test,	Must pass all the test for color vision
Merchant Navy	Safety check	Ishihara, Cambridge color test Martin Lantern	Color blind not permitted

Civil aviation	Safety check	Ishihara, Martin Lantern, Cambridge color test	Must pass Ishihara test and confirm with Martin Lantern test to identify signal colors, red, green and white color lights
Police and Fire service	Safety check	Ishihara, Martin lantern test	Police-Monochromats are rejected. Mild anomalous trichromats are accepted and are treated as normal. Severe anomalous trichromats and dichromats are also accepted and should be instructed in coping strategies. Fire - Minor color vision defects are acceptable
Navigation	Safety check	Ishihara, Cambridge color test	Failure to identify a colored signal or color code is likely to cause an operational error or accident
Chemical analysis (Colors)	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Color vision standards vary by industries based on work tasks, machinery, working environment
Color television and testing/maintenance professionals	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Must pass Ishihara test/Farnsworth-Munsell 100 hue test
Fine art and color photography	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Electrical workers	Safety check	Ishihara test,	Perfect to good color vision
Electricalengineering (hospitalandtechnicians industry)	Safety check	Ishihara test,	Perfect to good color vision
Color matching (textiles, paper, painting, and dyeing)	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Carpet industry (warpers, weavers)	Quality check	Ishihara, Farnsworth-Munsell100 hue	Perfect to good color vision
Horticulture	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Wood Industry (paper making)	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Transport workers	Safety check	Ishihara test	Perfect to good color vision
Painting and coating	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Fiber and textile	Quality check	Ishihara test	Perfect to good color vision
Biological, chemical, and geological sciences	Quality check	Ishihara, Farnsworth-Munsell 100 hue	Perfect to good color vision
Printing, paper, and photographic processing	Quality check	Ishihara test	Perfect to good color vision
Art, sculpture,	Quality check	Ishihara test	Perfect color vision

photography, and industrial design			
Graphic designer	Quality and safety check	Ishihara test	Perfect to good color vision
Chef	Quality check	Ishihara test	Perfect to good color vision

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Case review

Ocular Tuberculosis (OTB)

Arindam Chakravarti

One third of the world's population is infected by Mycobacterium tuberculosis and at risk if developing the disease.[1]

TB can affect multiple organs throughout the body. Ocular TB (OTB) is a rare extrapulmonary form of the disease which has a potential impact on visual loss in patients diagnosed with the disease. OTB remains a major diagnostic and therapeutic challenge, due to its heterogeneous clinical manifestations, lack of diagnostic criteria and gold standard tests, and lack of international agreement on the therapeutic approach. [2-6]

The reported prevalence of tubercular uveitis (TBU) is characterized by a wide variability worldwide, ranging from 0.2% to 2.7% in regions where TB is not endemic, including USA, Europe, or Japan, to 5.6%–10.5% in highly endemic areas such as India.[5-7]

Majority of the patients are diagnosed with presumed ocular TB based on local epidemiology, consistent ocular clinical picture, and positive corroborating tests, such as purified protein derivative (PPD) skin test and/or interferon gamma release assays (IGRAs). Patients are referred for initiating antitubercular therapy (ATT) based on the positivity of the immunologic test results, with no pathological findings on chest imaging and no active clinical signs of systemic disease. [3-6] Other causes excluded, clinical signs consistent with TBU play a significant role in the diagnostic process even in the presence of negative corroborating investigations, contributing to the increase in the uncertainty regarding diagnosis and management.[3,6,8]

The gold standard for the diagnosis of OTB is the direct demonstration of the MTB in tissues or fluids, but positive results are difficult to obtain by culture or smear from ocular samples due to the low yield of MTB and the small size of specimens.[4,5,8] In the setting of a paucibacillary disease, polymerase chain reaction (PCR) techniques were expected to be extremely useful for the detection of MTB. However, recent data from the Collaborative Ocular Tuberculosis Study (COTS)-1 group suggested how positive or negative results do not influence the management of the disease in the real world scenario, due to the low sensitivity and lack of standardization.

In view of these observations, diagnosis of TBU is mostly based on clinical phenotype and immunologic investigations. However, although these techniques are frequently used to reach a presumptive diagnosis, they have limitations related to sensitivity and specificity which implies that some caution is required in their interpretation.[3,5,6,8,9] In the absence of clinical findings suggestive of TBU, it might be rash for uveitis specialists to rely on a positive immunologic test result as indication for diagnosis, due to a low pretest probability in cases

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of low clinical suspicion, and the possibility of latent TB in a patient with ocular inflammation not TB related.[3,10]

Clinical Features and Nomenclature of Ocular Tuberculosis

OTB can affect any tissue of the eye and manifests most commonly as TBU. Different ocular phenotypes have been attributed to TBU. However, the lack of a general agreement among uveitis experts regarding the disease and its aetiopathogenesis resulted in the ambiguity of non-standardized terminology. Recently, the COTS group worked together with the International Uveitis Study Group (IUSG), International Ocular Inflammation Society (IOIS), and Foster Ocular Immunology Society (FOIS) in the "Standardization of Nomenclature for Ocular Tuberculosis" project, with the aim to address the ambiguity related to the terminology of OTB, and to promote uniform scientific seamless communication amongst the clinicians worldwide.[11]

Tubercular posterior uveitis (TPU), and more precisely tubercular choroiditis (TBC), is the most common manifestation of TBU.[4,11] Different phenotypes characterize the choroidal involvement in the disease.

Tubercular serpiginous like choroiditis (TB SLC) manifests as multifocal, initially discrete and later confluent, yellowish lesions, characterized by slightly raised edges, showing active edge wave like progression and central healing. In most cases, lesions are noncontiguous to the optic disc.[8,11-13] TB SLC can be unilateral or bilateral, and it is commonly associated with mild vitritis. Diffuse plaque like choroiditis is a distinctive pattern of TB SLC, characterized by solitary placoid lesions with an amoeboid spread.

CASE 1: Middle aged male with presentation of healed choroiditis in left eye (Fig 2a,b) and active serpiginious like choroiditis in right eye (Fig 1a,b), Mantoux and Quantiferon TB Gold positive with features of healed Kochs on HRCT scanning of chest, initially responded to oral Prednisolone at 1 mg/kg/ day, but developed steroid dependence on lower doses of Prednisolone with recurrent lesions in macula (Fig 3,4). The patient responded well to 9 month course of ATT with oral steroids combined with oral Methotrexate 15 mg weekly and oral steroids gradually being tapered and stopped and Tab Methotrexate also gradually reduced to maintenance dose of 2.5 mg weekly. This patient had no recurrence over a period

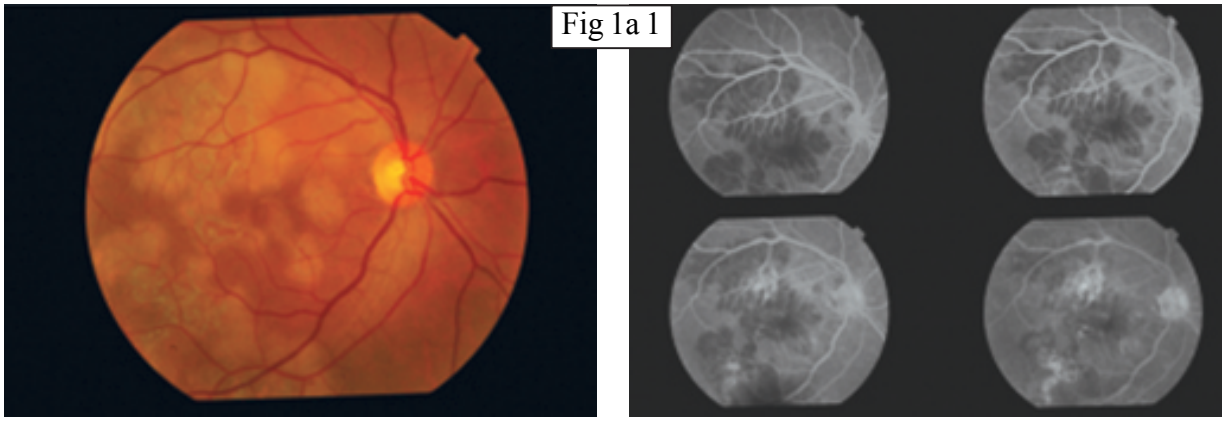
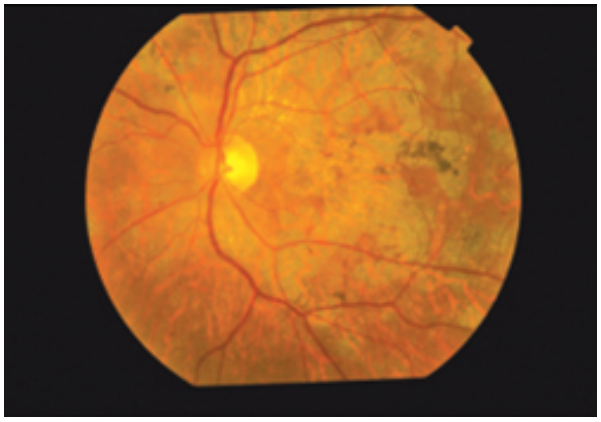


Fig 1a, b. On presentation, active choroiditis involving macula, away from disc with early hypofluorescence and late hyperfluorescence on FFA



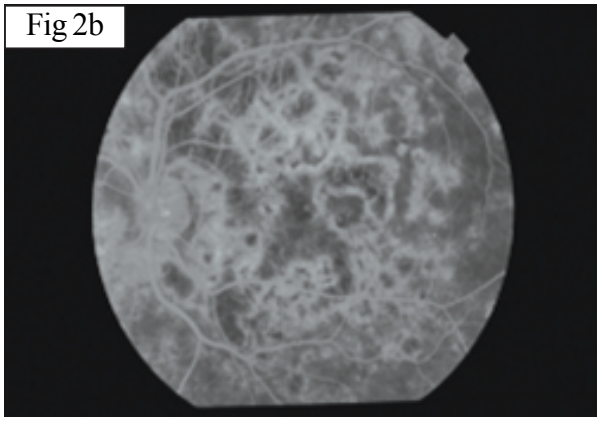
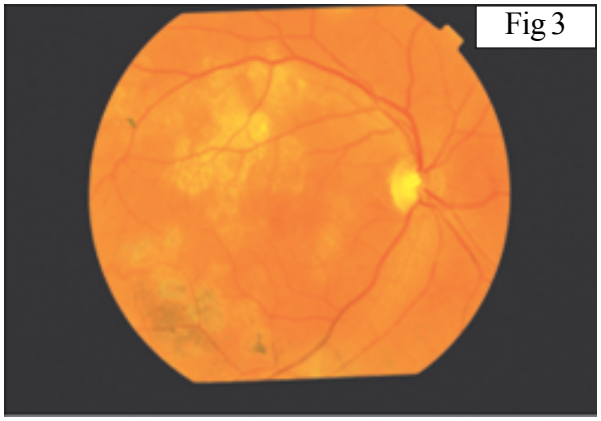


Fig 2a, b: Healed choroiditis involving macula in left eye with staining of lesions on FFA



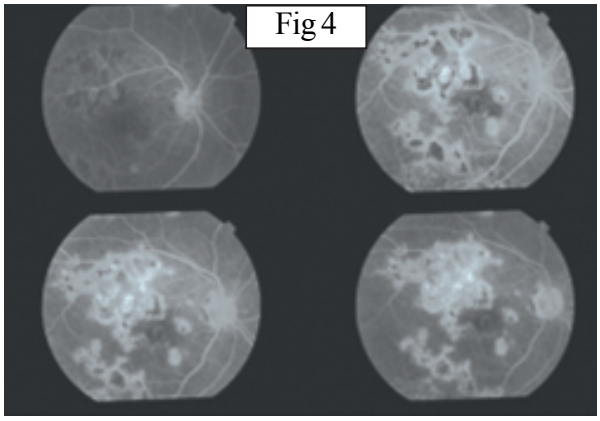


Fig 3 & 4: Recurrent choroiditis inferonasal and inferotemporal macula with FFA showing early hypofluorescence and late hyperfluorescence at the sites of activity and staining over the healed lesions. Recurrence noted on tapering oral steroids.

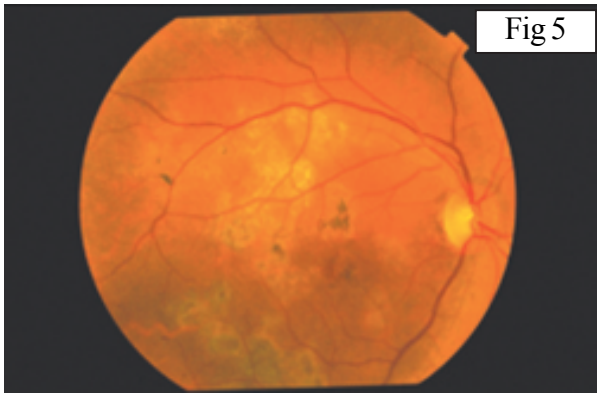


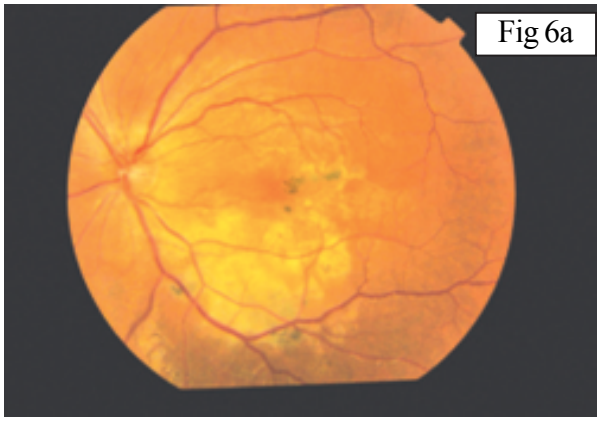
Fig 5: Healed serpiginious like choroiditis after course of ATT and on maintenance dose of Tab Methotrexate after 4 years. No recurrences noted. BCVA stable at 6/6

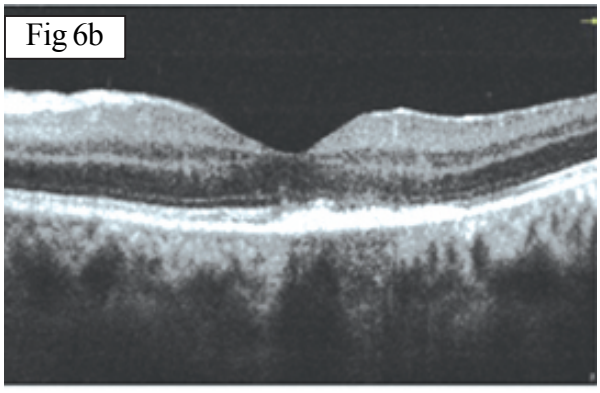
TBC can manifest as tubercular multifocal choroiditis (TB MC) or tubercular focal choroiditis (TB FC), involving choroiditis phenotypes not resembling TB SLC, such as idiopathic multifocal choroiditis or acute posterior multifocal placoid pigment epitheliopathy (APMPPE) in case of multifocal manifestation.[11,14] Choroidal tubercles have been classified as part of TB MC phenotype.[11] Representing ocular manifestations of disseminated TB indicating hematogenous spread of MTB, tubercles usually appear as multiple, small, grayish yellowish nodules, unilateral or bilateral, predominantly located at the posterior

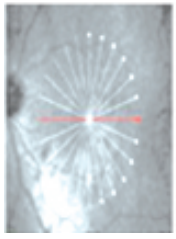
pole. When lesions are active, borders are indistinct due to the surrounding rim of inflammation, resulting in pigmented scars when healed.[8,11]

Tuberculoma is a well known phenotype and a prototype of the choroidal manifestation of the disease.[8] It manifests as a single or multiple, yellowish, subretinal lesion with fuzzy borders, surrounded by exudative fluid, typically located in the posterior pole or in the mid periphery at the level of choroidal stroma.[15,16]

Case 2 : 24 years old healthy lady presented with features of focal macular choroiditis in left eye.(Fig 6 a,b,c) She had no immunological evidence of Kochs, Mantoux test was negative and HRCT chest was clear. She had good response to oral Prednisolone at 1mg /kg (Fig 8 a) but she started developing multiple focal choroidal lesions (Fig 7 a,b) over a period of ten months, especially on tapering steroids. However the lesions resolved on increasing the dosage of oral Prednisolone.(Fig 8b) A year later, her choroidal lesions resembled tuberculoma, with a clinical picture of retinochoroiditis; as demonstrated on FFA and OCT (Fig 9a,b,c). Patient refused ATT despite being steroid dependent, however in due course, she developed massive scleritis along with large tuberculoma and haemorrhages.(Fig 10a,b). She was treated with ATT and IV methylprednisolone but she developed paradoxical reaction. Subsequently she underwent treatment in a different institution but she developed long term sequelae to recurrent inflammation with vision loss and macular scarring (Fig 11).







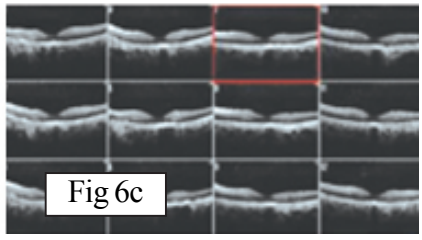


Fig 6a,b,c: On presentation, active focal macular choroiditis with OCT showing mild RPE irregularities, no choroidal elevation and patchy early hypofluorescence followed by late hyperfluore scence on FFA

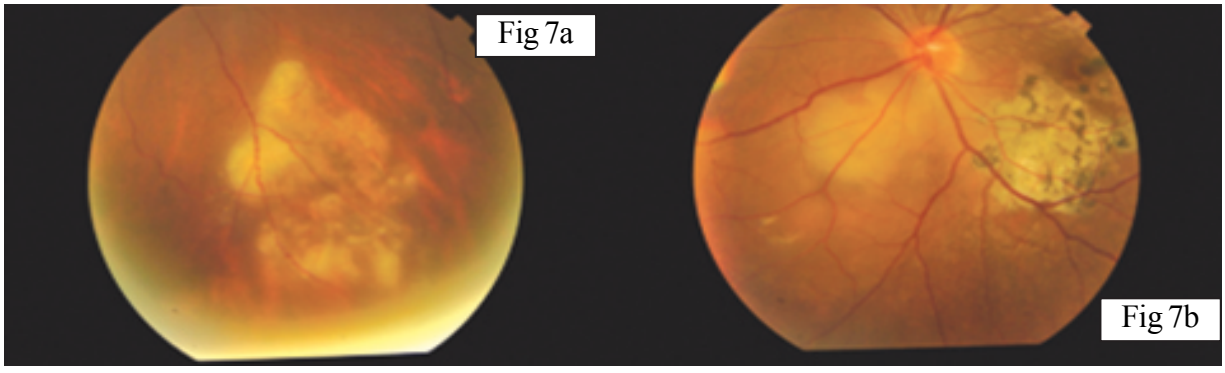


Fig 7a, b: New patches of focal retinochoroiditis on tapering oral steroids

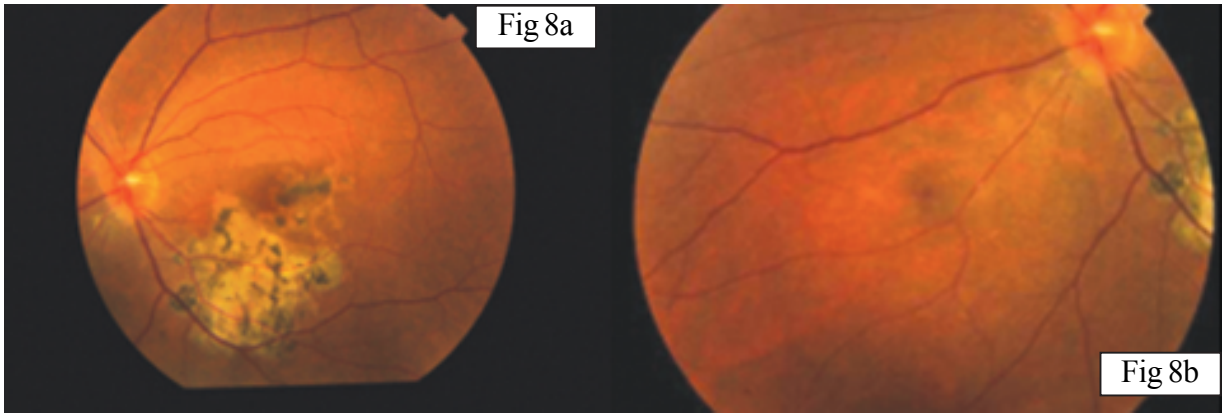
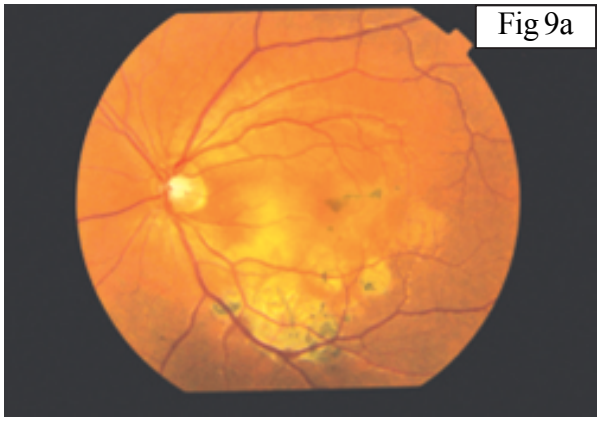
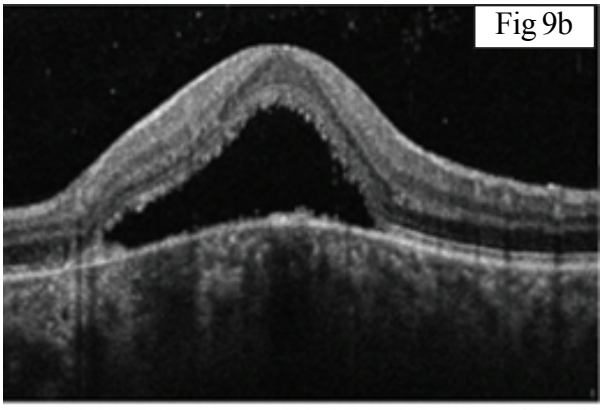


Fig 8a, b: Healed lesions after increasing dosage of oral Prednisolone





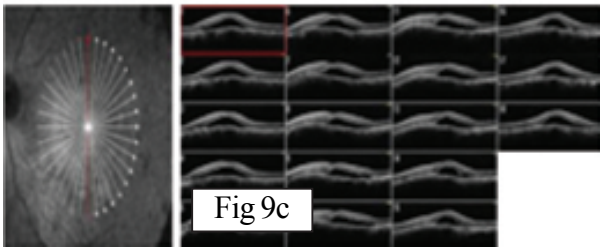


Fig 9 a,b,c: Active retinochoroiditis with choroidal elevation and SRF pockets in OCT. FFA shows large areas of deep hypofluorescence/almost blocked fluorescence (more suggestive of retinitis) with staining of scars around lesion in late phase

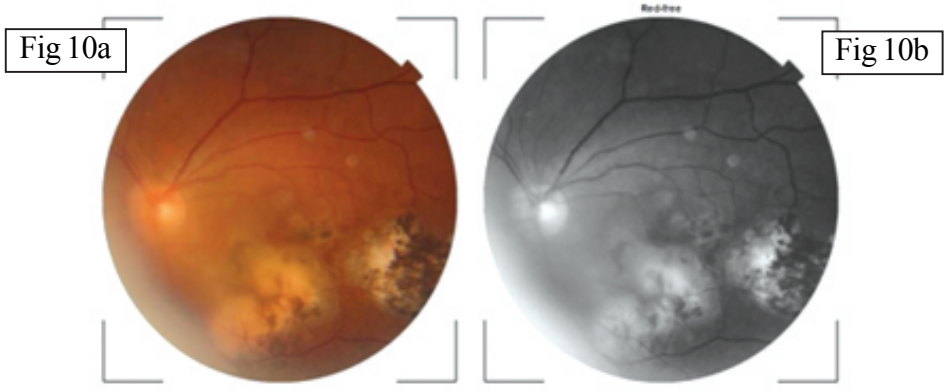


Fig 10a, b: Classic tubercular granuloma with specks of haemorrhages and posterior scleritis.

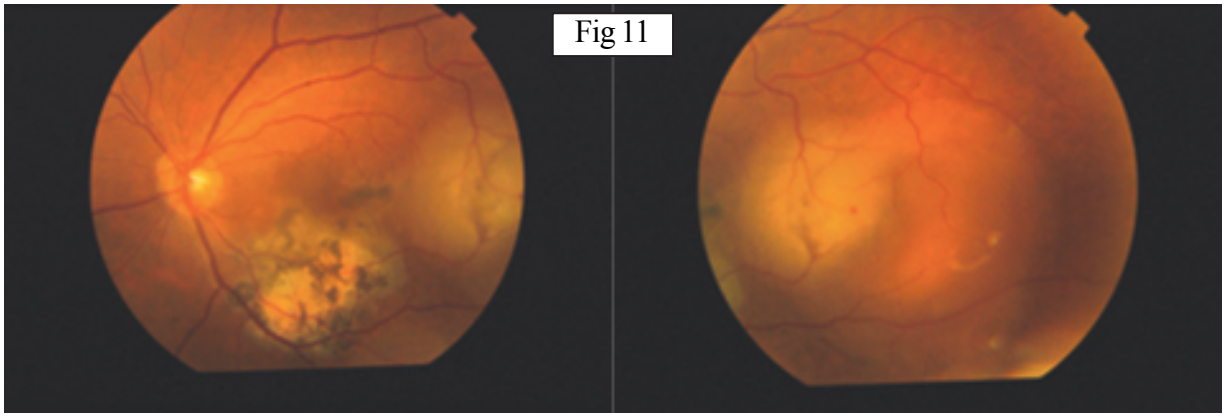


Fig 11: Sequelae of recurrent inflammation and paradoxical reaction with extensive scarring involving macula

Case 3: 24 years old healthy lady had features of serpiginious like choroiditis with partly active lesions in right eye. Systemic work up findings of strongly positive Mantoux, positive Quantiferon Gold and features of healed Kochs in HRCT scan lung indicated a diagnosis of tubercular SLC. She was started on ATT by chest physician; but it resulted in a major flare up of the choroiditis lesions temporal to macula (Fig 12a,b,c) and they started relentlessly progressing towards the macula. The lesions had typical features of tubercular SLC with central healing and edges progressing in amoeboid pattern. Patient required high dose oral Prednisolone, 1.5 mg /kg daily following which the active lesions started resolving and the paradoxical reaction settled. Last follow up showed mostly resolved choroiditis lesions(Fig 13a,b) but fundus autofluorescence still showed some areas of hyperfluorescence (Fig 13c), Fig 12a a clear indicator towards cautious tapering of oral Prednisolone.

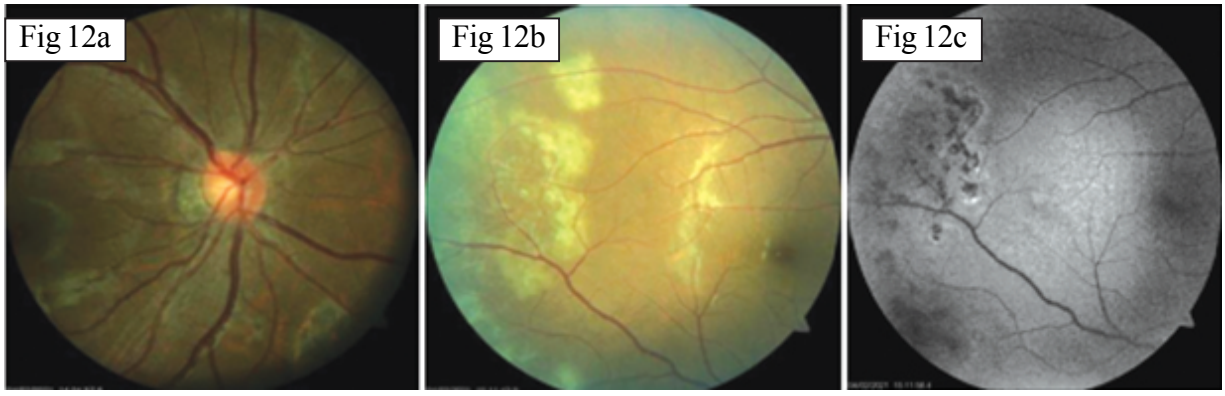


Fig 12a, b, c: Healed SLC lesions inferonasally and superonasally with active lesions temporal to macula, confirmed by fundus autofluorescence.

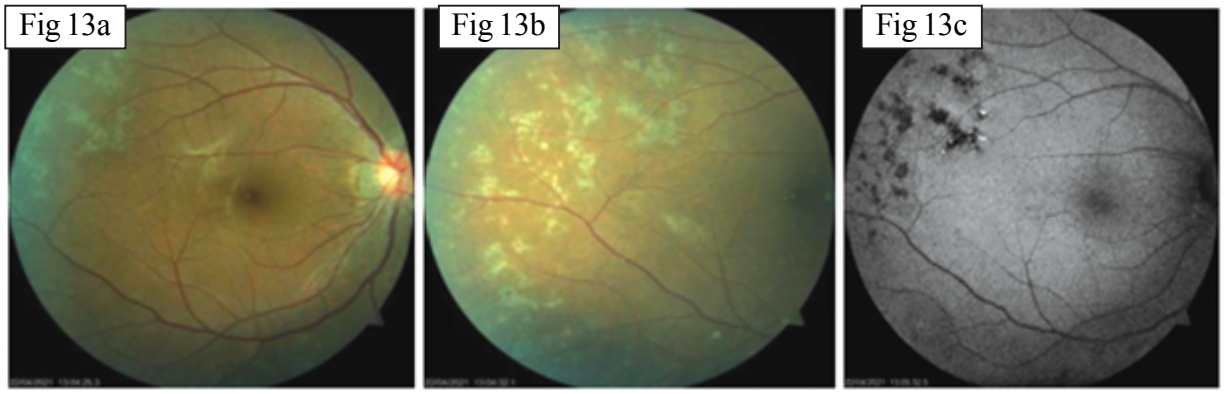


Fig 13 a,b,c: Mostly resolved SLC lesions temporal and superotemporal to macula following management of paradoxical reaction to ATT by high dose oral steroids. Areas of hyperfluorescence on FAF indicate incomplete resolution of SLC, necessitating cautious steroid tapering.

Among tubercular posterior uveitis (TPU), tubercular retinal vasculitis (TRV) is characterized by an occlusive phenotype, manifesting as retinal periphlebitis with primarily involvement of the veins rather than the arteries. It typically appears as perivascular sheathing with exudates and retinal hemorrhages.[8,17] (Fig 14) The presence of perivascular choroidal pigment or small choroiditis patches is highly suggestive of tubercular etiology[18] Complications include macular edema and, considering the occlusive nature of the vasculitis, retinal or optic disc neovascularization, resulting in vitreous hemorrhage, tractional retinal detachment, iris neovascularization, and neovascular glaucoma. The term Eales disease, which by original definition is an idiopathic form of vasculitis, indicates a disorder characterized by occlusive retinal periphlebitis with high risk of retinal neovascularization and related sequelae, usually occurring in healthy young male individuals coming from TB endemic areas, has been strongly correlated to an immune mediated reaction to MTB.[8,17] Uveitis experts agreed on the use of the term TRV to be preferred to Eales disease in those cases of TB related retinal vasculitis, since there is no pathological distinction between the two entities.[11]

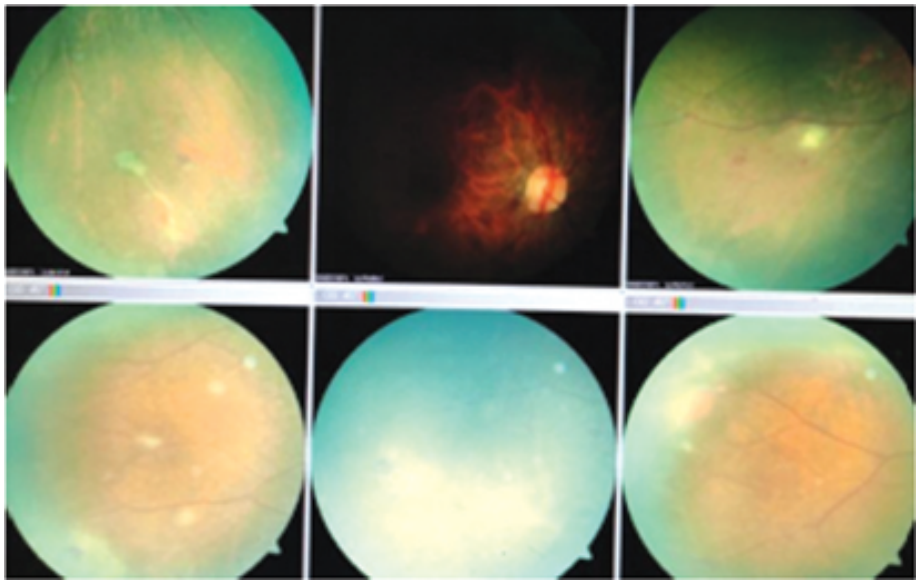


Fig 14: TRV manifesting with old occluded veins inferonasally and active perivascular exudates with retinal haemorrhages inferotemporally and temporally

The most common manifestation of TBU after TBC is tubercular panuveitis (TPU), characterized by anterior chamber, vitreous, and retina and/or choroid involvement, followed by tubercular anterior uveitis (TAU).[8,17] TAU is typically a granulomatous form of anterior uveitis, unilateral or bilateral, characterized by large mutton fat keratic precipitates and broad based posterior synechiae.[8,17] In severe cases, nodules on pupillary border or iris surface can be detected. Cataract is a common complication of TAU due to both chronic inflammation and prolonged use of topical corticosteroids.[8,17]

The term intermediate uveitis represents a subtype of uveitis where the vitreous is the primary site of inflammation.[17] Tubercular intermediate uveitis (TIU) manifests as low grade, chronic intraocular inflammation, characterized by vitritis, inferior snowballs, peripheral vascular sheathing, often complicated by cystoid macular edema.[8,19,20]

TBU accounts for a wide and heterogeneous spectrum of clinical manifestations and, therefore, the diagnosis still poses a significant challenge, especially in regions non endemic for TB. Ocular phenotype, together with patient's region of origin and investigations results, must always be considered in the differential diagnosis with other entities mimicking similar phenotypes.

Aetiopathogenesis

The aetiopathogenesis of OTB – intraocular infection with MTB, should be implied in the terminology itself. Yet, the association between the disease and its causative organism has remained tenuous, owing largely to the rarity of microbiological isolation and molecular evidence of MTB in clinical samples obtained from patients.

The direct effect of MTB infection in aetiopathogenesis of OTB is supported mainly by the beneficial role of ATT in resolution or non recurrence of inflammation in OTB.[2,21,22] However, the therapeutic efficacy of ATT is not enough to distinguish if the infection is latent or involves active/replicating bacilli. Further support for direct role of MTB is obtained from histopathological studies that demonstrate granulomatous inflammation in different ocular tissues with giant cells and areas of necrosis.[23,24] Very few acid-fast bacilli (AFB) are found. Such studies are generally available from enucleated specimens, though biopsy studies from human eyes are also reported.[25,26] The most unambiguous representation of direct mechanism is probably choroidal granuloma. AFB have been isolated in choroidal granuloma of human OTB. Finally, multiple animal models of OTB are available which demonstrate dissemination of MTB from the peripheral circulation to cause granulomatous inflammation in the eye.[27-30]

The indirect effect of MTB is mostly supported by general lack of microbiological/molecular evidence of MTB in ocular fluid samples and therapeutic response of clinically diagnosed OTB to corticosteroid treatment alone.[21] Further support is provided by analysis of intraocular T cells from vitreous samples of OTB that revealed presence of autoreactive (retinal antigen specific T cells) in addition to the TB specific T cells.[31] TB SLC phenotype probably best demonstrates the presence of, or at least the coexistence of, indirect mechanisms in OTB. This phenotype has a unique pattern of clinical progression (superficially, at the lesion margins, or as multifocal lesions), not explained by the histopathological appearance of tubercular granuloma, and tends to worsen clinically developing paradoxical worsening, if not treated with adjunctive corticosteroids.[13]

It is likely that both direct and indirect mechanisms coexist in the aetiopathogenesis of human OTB. However, the relative contribution of each mechanism to individual phenotypes such as retinal vasculitis or serpiginous like choroiditis or different stages of disease may vary and should be addressed by future studies. Direct mechanisms could dictate

focus on bacteriological diagnosis and therapy, and indirect mechanisms on primary anti inflammatory therapy with adjunctive ATT.

Recent advances in technology established the role of multimodal imaging in the diagnosis and management of OTB. Detecting a phenotype or clinical picture suggestive of OTB is essential to make a presumptive diagnosis, and monitoring the course of the disease plays a key role in the correct therapeutic management. Techniques, such as FA, ICGA, and OCT, together with novel imaging modalities, including FAF, ultrawide field (UWF) imaging, and optical coherence tomography angiography (OCT-A), supplement each other and provide useful information on the natural course and therapeutic response of the disease.

Laboratory and Radiological Investigations

The gold standard for the diagnosis of OTB is the detection of MTB in tissues or fluids, providing confirmatory evidence of the pathogen through aqueous and/or vitreous sampling.

Nucleic acid amplification technique (NAAT), including PCR, are able to amplify DNA of small genomic sequences. Although, in the setting of a paucibacillary disease PCR can be extremely useful for detecting MTB, a definitive diagnosis of OTB is often difficult to obtain due to the low sensitivity of the technique applied to ocular samples characterized by small size and low mycobacterium yield.

Most of the NAATs, including PCR and real time (RT)-PCR, utilize a single target specific for MTB, namely IS6110 and MPB64. However, IS6110 is absent in 10–40% of MTB samples, especially in endemic areas, where the likelihood of false negative results is higher, and the reported sensitivity of single gene targets techniques applied to ocular specimens is 37%–58.82%.[32-35] A multitargeted PCR characterized by simultaneous amplification of three targets specific for MTB, namely, IS6110, MPB64, and protein b, has been showed to have enhanced sensitivity. Sharma *et al.* demonstrated a sensitivity and specificity of 77.77% and 100%, respectively, when multiplex PCR (MPCR) is applied to patients with presumed OTB, with a positive and negative predictive value of 100% and 88.88%, respectively.[36]

Most current research has focused on novel techniques of nucleic acid amplification, including GeneXpert MTB/RIF assay and Line Probe Assay (LPA). GeneXpert MTB/RIF assay is based on a hemi-nested RT-PCR technique, using molecular beacon technology to detect both **MTB genome** and **rpoB gene** mutations for rifampicin resistance. Although a report by Sharma *et al.* showed a sensitivity of 22.3% and a specificity of 100% when applied to vitreous samples, the test can provide extremely useful information on drug resistance and thus, explain recurrences despite ATT.[37] LPA, including GenoType MTBDR*plus*, uses a reverse hybridization technique to detect specific mutations in rpoBgene for rifampicin resistance, and InhA and katG genes for isoniazide resistance. Bansal *et al.* utilized three different molecular techniques to detect MTB DNA in the vitreous of 11 eyes with multifocal serpiginoid choroiditis. All eyes were tested with MPCR, Genexpert MTB/RIF assay and GenoType MTBDRplus. Ten eyes resulted positive for MTB DNA using MPCR, six eyes were positive for MTB genome using MTBDR Plus, with rifampicin resistance detected in three cases, and four eyes were positive using GeneXpert, with rifampicin resistance detected in one case.[38] In view of these observations, the diagnosis of OTB is commonly a presumptive diagnosis based on positive immunologic investigations in association with a consistent ocular phenotype.

Baseline immunological testing includes PPD skin test and IGRAs. Both tests work on the principle of cell mediated immunity. PPD skin test detects skin hypersensitivity for mycobacterial antigens including PPD of tuberculin, while IGRAs test interferon γ release after *in vitro* stimulation of patients

lymphocytes with MTB specific antigens (ESAT 6 and CFP 10). Both tests do not distinguish between active and latent disease, and have limitations related to sensitivity and specificity, implying that caution is required in the interpretation.

PPD skin test has a low positive predictive value and a high false negative rate in the absence of systemic disease, whereas IGRAs, although more specific, have a high false positive rate.[3,6,10] Thus, in the absence of clinical findings suggestive of OTB, physicians should not rely on positive IGRA as indication of disease diagnosis.[39] IGRA has a low pre test probability in cases with low clinical suspicion (approximately 90% of positive IGRAs can be false positives), and the possibility of a latent TB in a patient with ocular inflammation not related to TB must be considered, especially in regions of the world where TB is endemic.[3,6,10] Screening for TB should be thus discouraged in low risk groups, and immunological tests should be considered for the initiation of ATT only in the context of a strong clinical suspicion. PPD skin test may be positive in patients immunized with Bacillus Calmette Guerin (BCG) vaccination and in case of atypical mycobacteria. IGRA is a more specific marker of MTB exposure, not affected by prior BCG vaccine and nontuberculous mycobacteria.[3,6,10] Although more specific, data relating to its sensitivity compared to PPD skin test are variable and still inferior to the ideal. Some authors thus recommended using both the investigations, to enhance sensitivity and specificity in the context of suggestive ocular phenotype.[3,6,10]

Being an extrapulmonary form of the disease, OTB commonly occurs without any evidence of pulmonary involvement. Although most patients have no clinical signs of active pulmonary disease, radiology can be useful, providing evidence of old healed TB. Results from COTS-1 showed that among 702 patient affected by OTB with documented radiological results, 26.9% had radiologic features suggestive of inactive TB on chest X ray, and 68.6% had positive findings on chest computed tomography (CT).[40]

CT appears to be more a sensitive technique that can be a valuable diagnostic tool in patients with ocular findings suggestive of OTB and history of exposure with no signs of active infection.

When to Treat?

The role of ATT in OTB is still controversial, and there is no international agreement on therapeutic regimen and treatment duration.[3,5,22,41,42] There is a wide heterogeneity in drugs and regimen adopted, depending on the area of practice, TB endemicity, local diagnostic and therapeutic protocols, and personal experience in treating the disease.

Available evidence indicates efficacy of ATT in reducing the rate of disease recurrences in patients with OTB treated with ATT.[2,22,41]

A meta-analysis from 28 studies evaluated the effect of ATT on the ocular outcome of 1,917 patients.[22] The results showed that 84% of patients treated with ATT did not experience recurrences of inflammation during the follow up. Similarly, data from COTS-1 reported a treatment failure rate of 12.6% in patients treated with ATT.[41] However, there is a lack of randomized control trials for treatment of OTB.

The role of concomitant administration of oral corticosteroids and immuno-suppressant agents is controversial too, and there is no agreement on their efficacy in patients with TBU treated with ATT.[22,41] Steroid and immuno-suppressive agents are supposed to control intraocular inflammation and limit the damage to ocular tissue caused by delayed hypersensitivity reaction, during the active phase of the disease or in case of paradoxical worsening.

COTS-1 reported a treatment failure rate in patients receiving ATT alone or in combination with oral steroids of 7.3% and 12.6%, respectively.[41] By

contrast, the meta-analysis did not observe significant difference in treatment outcome between the two groups, showing a successful outcome in 85% and 82% of patients receiving ATT alone and ATT together with oral corticosteroids, respectively.[22]

To address the uncertainty in the management of OTB and bridge the gap between clinical need and medical evidence, the COTS group, in collaboration with IUSG, IOIS, and FOIS, has recently developed consensus guidelines for the initiation of ATT for specific clinical phenotypes and proposed guidelines for concomitant adjunctive therapy in patients with TBC.[43] From the study it emerged that specific sub-phenotypes of TBC influence the therapeutic decision of starting ATT, as well as TB endemicity in the geographical region of patient's origin.

In TB SLC, given the strong association of the sub-phenotype with MTB, even one positive immunologic evidence, namely a positive PPD skin test or IGRA, not supported by radiologic findings, is considered enough to start ATT.

Similarly, tuberculoma is highly representative of TBU, and therefore, even in this sub-phenotype experts recommended starting ATT in the presence of any single immunologic evidence for TB infection. In addition, if the patient comes from endemic areas, a positive radiologic finding alone justifies starting the treatment regimen in patients affected by tuberculoma.

By contrast, TB MC and TB FC are less likely considered TB related and the administration of ATT in affected patients should always be supported by one immunological test together with radiological findings of active or healed pulmonary TB.

Systemic corticosteroids could be initiated concomitantly with or soon after the administration of ATT in patients with TB SLC, tuberculoma with no active systemic infection, and TB MC/TB FC, unless there is a high risk of significant ocular complications due to severe inflammatory reaction.[43] When the inflammation recurs during tapering, systemic corticosteroid sparing immunosuppressants can be started in patients with TB SLC and TB MC/TB FC.

Recently local therapy has been successfully used in the management of TBU as an optional adjunctive anti inflammatory therapy.[44-46] Although the experience is limited, patients diagnosed with TIU, TRV, and TB SLC have been treated with intravitreal injection of dexamethasone implants in case of corticosteroid intolerance, cystoid macular edema, and paradoxical worsening. Concomitantly with ATT administration, the device demonstrated its efficacy in the management of macular edema, vitreous haze, and choroidal lesions.

Paradoxical worsening can occur in patients treated with ATT or with both ATT and systemic corticosteroids, due to severe inflammatory response, and/or inadequate immunosuppression. Paradoxical worsening is suspected if clinical features deteriorate after starting ATT. Manifestations include both worsening of the preexisting lesions or development of new lesions at the same location or at different sites. Mechanism is due to release of MTB antigens from dying bacilli after initiation of ATT, leading to severe host's immune response. Bansal *et al.* routinely administer oral prednisolone (1 mg/kg/day) in combination with ATT, with a slow tapering (5 mg/day every 2 weeks), based on clinical features and autofluorescence findings of the lesions.[13,4] Patients might sometime require additional immunosuppressive therapy.[13]

Cases of continuous progression of TB-SLC despite ATT and systemic anti inflammatory treatment successfully treated with dexamethasone intravitreal implant have been reported too.[44,47]

Conclusion

In conclusion, the decision to treat OTB is usually made by the ophthalmologist. Chest and infectious disease physicians have to rely on the suspicion of

TBU of the referring ophthalmologist to start ATT, based on history of exposure, supportive ocular findings, and corroborating investigations. A globally unified collaborative effort has been made by the COTS group to address the uncertainty related to the management of TBU, and consensus guidelines for initiation of ATT will be of significant help for both physicians and patients. Prospective clinical trials are needed to better assess the role of ATT and adjunctive therapy in patients affected by OTB and set up concordance on treatment regimen among the experts worldwide.

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Practice patterns

Aesthetic Practices in Ophthalmology

Amarendra Deka

Aesthetic procedures, including botulinum toxins, dermal fillers and lights/lasers, is a natural addition for an eye care practice. After all, the use of therapeutic botulinum toxins was started by an ophthalmologist[1], and the majority of cosmetic injections of neurotoxins are around the eyes. As far as lights and lasers, we as ophthalmologists have trained extensively on the use of lasers in the eyes, so we already have a basic knowledge of laser technology and physics.

Consideration of adding aesthetics into our practice should be taken seriously only if we are passionate about this area of medicine. Given the vast competition amongst multiple specialties, setting up this part of a practice takes time and dedication. Make sure that our staff is also eager for the addition as they are going to be the front line to the aesthetic patients. Probably it is an easy task for solo practice compare to group practice as cooperation of every individual is necessary.

When we talk about aesthetic practices, being ophthalmologist we think only about injectables like botulinum toxins and fillers. In reality aesthetics practice is very vast, we can't start aesthetic practice depending only on injectables. For setting up of an aesthetic centre we don't need special infrastructure. Existing staffs can be trained for minor non invasive procedures, however injectables and lasers should be done only by well-trained personnel.

There is currently no internationally accepted definition of aesthetic practice. The American Board of Cosmetic Surgery has defined cosmetic surgery as "a subspecialty of medicine and surgery that uniquely restricts itself to the enhancement of appearance through surgical and medical techniques. It is specifically concerned with maintaining normal appearance, restoring it, or enhancing it beyond the average level toward some aesthetic ideal[2]."

According to the International Survey on Aesthetic Procedures Performed in 2010 (revised – January 2013) by the International Society of Aesthetic Plastic Surgeons (ISAPS), the most common non-surgical procedure performed in India was botulinum toxin Type A injections followed by hyaluronic acid fillers, laser hair removal, autologous fat injections and intense pulsed light (IPL) laser treatment. In the United States, there were nearly 11.5 million surgical and non-surgical procedures performed, according to statistics from the American Society for Aesthetic Plastic Surgery (ASAPS). They also report that the number of cosmetic procedures for men has increased by more than 273% between 1997 and 2013[2].

Several factors can be attributed to the increasing demand for aesthetic procedures, namely:

- Technological and medical advances whereby new cosmeceuticals and devices have been invented to treat cosmetic disorders with minimal downtime and complications.
- The desire to look youthfulness and self-image.

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- Professional compulsions to undergo cosmetic procedures.
- Aesthetic procedures have become "need felt" and hence, this article aims to guide ophthalmologist how to set up a professional and ethical aesthetic practice.

Purpose: Maintain a centre of excellence in all aspects. One should have an integrated practice of clinical and cosmetic. For example if an acne patient comes to the clinic, we would require to treat the active acne by dermatologist and plan to treat the acne scars or post inflammatory hyperpigmentation subsequently. Keep up to date with the latest and recent advances so as to offer our patients the best possible treatment available.

Training: The first step is to learn. There are numerous courses both didactic and hands on for the practitioner to learn about aesthetics. Some courses are available at large conferences, while others are presented in small roundtable settings. There are many fellowship programs that are designed to equip us with the necessary skills for practicing aesthetics. Working as an understudy to a cosmetic practitioner will also help to gain experience.

Patients: it was observed that about 30% of patients attending ophthalmology clinic has aesthetic concern. So we can counsel our own patients who has attended our outpatient department for aesthetic procedures. Later on we can increase client base by various activities.

Always be an aggressive listener and communicate effectively. It is always better to avoid doing a procedure on the first consultation with the patient, as this would give them time to think and to prepare themselves.

Always address the concerns of the patient. This will instill confidence in the patient. We should call them for regular follow up and monitor the progress of the condition.

Procedures: Before doing any procedure, make sure you have explained adequately to the patient - the procedure details, alternatives available, risks involved, complications that can arise, outcome expected, duration of treatment and expenses involved[3].

When one is beginning aesthetic practice, it is important to start with basic aesthetic procedures, gradually gain confidence and improve one's skill. For example, learn and master the art of basic chemical peels or toxin injections rather than beginning with complicated or advanced procedures.

Photography: it says that a picture speaks a thousand words; hence, good and standardized imaging is very essential. Good photographs help in monitoring the progress of a disease or condition help to communicate effectively with scientific communities during presentations and publications[3].

Performance evaluation trials of new equipment: New machines that come into the market/chamber that claim to be effective in various conditions can be tested by performing evaluation trials before being offered to patients. Using good imaging methods and other devices like chromometer or mexameter, we can assess the effectiveness of the machine[4].

Skin care products: The knowledge of basic skin care products are very important. Because it plays an important role in aesthetic practice.

Patient records: It is essential to maintain a database of patient records. It not only becomes easier to remember past details of patients' treatment and procedures, but also helps in building a rapport with the patient. Numerous online systems are available to doctors that allow patients not only to book appointments online, cancel appointments but also to get SMS reminders of the time and date of their appointment.

Publicity: Internet marketing and mobile advertising is the latest means of mass communication.

However, this is a controversial topic and one needs to be ethical and follow guidelines defined by medical boards. An attractive and informative website is an important prerequisite. Ensure that all information is accurate and genuine.

Promote: Tell readers, listeners, viewers what's new in the world of cosmetic dermatology, so that any new technologies that have been introduced in the market recently can be conveyed to the consumers. Invite your audience to learn more by attending your online "Webinars" either through email, patient newsletter, social media or personal blogs etc. touch base with them.

Problems: Counselling the patient adequately is most essential in aesthetic practices. Have a conservative approach and make sure that the patients have realistic expectations. If a complication arises, treat the patient sympathetically and gently, rather than ignoring the patient. Offer to see the patient more frequently to allay patient fears. Corrective treatment may be offered free of charge.

Conclusion

Aesthetic is becoming a vital and important branch of medicine. To meet and anticipate patient needs, it is necessary to ensure that the technologies being invested in are tried and true and "work the way they say they will". Have a sense of proportion and stick to it. Patients will appreciate our offering additional facial aesthetic services they want in a doctor's office where they already feel trust and confidence.

Source of Support : Nil.

Conflict of Interest : None declared.

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Case report

Conjunctival Papilloma in a 5year old child: a case report

Sandhya Yadav, Jyoti Bhuyan

Abstract:

Conjunctival papilloma is an acquired benign epithelial tumor originating from squamous epithelium. This tumor most commonly occur in the age group between 20-39years and rare in children. We report a 5 year old boy presenting with multiple pedunculated growth in upper and lower fornix of right eye. After thorough evaluation, surgical excision along with adjuvant double freeze cryotherapy was done and diagnosis was confirmed histopathologically. Although recurrence is quite common in children but no tumor recurrence noted 6months after surgery which revealed surgical excision to be preferred modality of treatment and patient is in follow up.

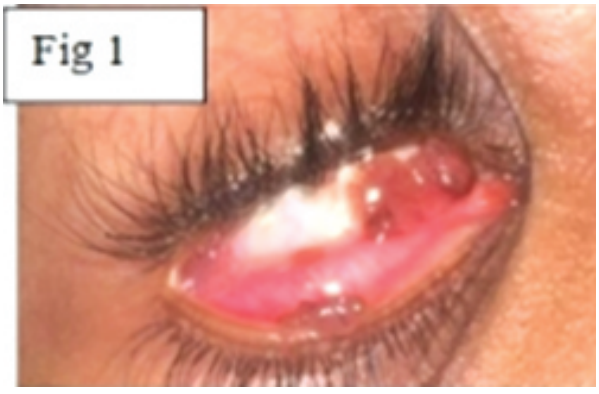
Keywords: conjunctival papilloma, Human papilloma virus, children

Introduction:

Conjunctival papilloma is a benign neoplastic tumor of epithelial origin with a low risk of malignancy.1 While papilloma lesions are known to affect both children and adults, those between the ages of 20 and 39 are the most likely to develop them2 and rarely children are affected.1 Human papillomavirus (HPV) is thought to be a significant risk factor, however the aetiology is unknown.1

Case Report:

A 5 year old boy presented with history of multiple fleshy growth in right eye with foreign body sensation since last 6 months. The lesion was gradually increasing in size involving both upper and lower palpebral conjunctiva of right eye and there was increased dryness due to inadequate closure of eyelids. (Fig.1)



There was no history of ocular trauma, ocular surgery or maternal exposure to Human Papilloma Virus (HPV).On examination, there were multiple pigmented exophytic growth involving almost 2/3rd of tarsal plate and inferior fornix of both upper and lower lid of right eye without any feeder vessels. Visual acuity was found to be 6/6 in both sides. Under topical anesthesia, tumor palpation was carried out with a cotton-tip applicator which revealed freely mobile growth over the sclera. Anterior segment

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and posterior segment examination were within normal limit. After excluding any systemic illness, excisional biopsy was carried out under General anesthesia.

Surgical excision of all the fleshy growth along with adjunctive therapy with double freeze thaw cryotherapy was done. (Fig.2) Bleeding was controlled with the use of cautery and primary closure of conjunctiva was done after subconjunctival injection of gentamycin 0.5ml.

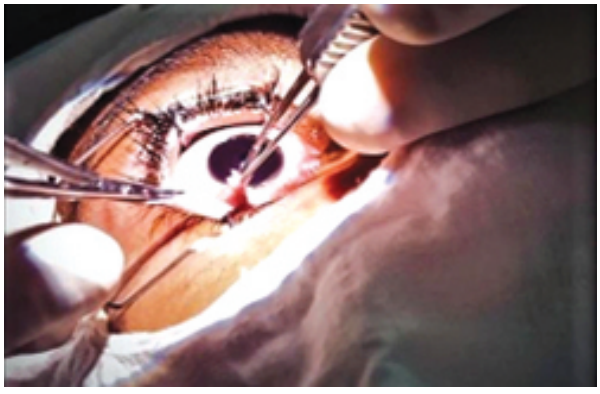

Fig 2: Surgical excision of all fleshy growth

Histopathology showingnonkeratinized stratified squamous epithelium with multiple branching fronds arising from narrow pedunculated base along with numerous goblet cells and inflammatory cells with no cellular atypia.

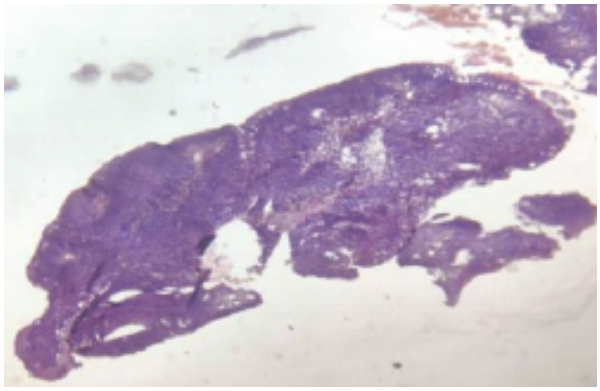

Fig 4: Histopathology

No recurrence was noted at 6 months after surgery and patient is on follow up.

Discussion: Conjunctival papilloma are most frequently associated with type 6,11 HPV.1,3 These virus can transmit to ocular surface either by vertical transmission from mother to child during delivery or via contaminated surface or hand.5 There are several different techniques to treat conjunctival papillomas, including both surgical and medicinal ones. Multiple recurrences of papillomas might complicate their course, particularly in the pediatric population.4 Multiple factors like age, location, extent, and the aggressiveness of the papilloma, systemic comorbidities, patient compliance to medical therapy and financial stability all play a role in the treatment plan for each patient. Small, asymptomatic conjunctival lesions can be treated with observation and reassurance, which is appropriate and recommended.1,4 Various treatment options are available for primary as well as recurrent tumor such as surgical excision, cryotherapy, topical mitomycin c, carbon dioxide laser, oral cimetidine, oral dinitrochlorobenzene, interferon alpha-2 beta.6,7,8,9 Considering the age of our patient, surgical excision was preferred as debulking can also reduce the overall viral load.

Conclusion:

This tumor is usually easily identified by clinical examination since the conjunctiva is a readily visible structure, although tarsal lesions may be missed in the absence of eyelid eversion. Early diagnosis and timely management in children can prevent development of amblyopia.

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Case report

Honeycomb Keratopathy after Netarsudil use

Charu Arora, Shahinur Tayab, Dollytutu Gogoi

Abstract:

Netarsudil, a new topical anti-glaucoma agent belonging to Rho kinase inhibitors was approved by the United States food and drug administration five years back. The Rho Kinase elevated intraocular pressure treatment (ROCKET) trial investigated the efficacy and safety of Netarsudil. It listed the side effects of conjunctival hyperaemia, corneal verticillata, and subconjunctival haemorrhage. Reversible honeycomb keratopathy is another side effect documented by several authors. We describe a case of honeycomb keratopathy forty-eight hours following the use of a single drop of Netarsudil eye drop. It resolved completely within ten days of withdrawing the offending drug.

Keywords: honeycomb keratopathy, Rho kinase inhibitor, netarsudil side effects.

Introduction:

Netarsudil is a new addition to the anti-glaucoma treatment basket. The most commonly reported side effect is conjunctival hyperaemia. Corneal verticillata is another side effect that is reported in up to 26% of patients in the Rho Kinase elevated intraocular pressure treatment (ROCKET) trial.[1] Apart from being used as an anti-glaucoma agent Netarsudil is also used to treat corneal edema.[2] However, interestingly it can give rise to reticular corneal edema or honeycomb keratopathy as a side effect.

Here we present the case of a honeycomb keratopathy, which developed in a case of neovascular glaucoma with a single drop of Netarsudil.

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Case Report:

A 45-year-old gentleman reported to our clinic with the chief complaint of diminution of vision in the right eye for six months and in the left eye for ten days. It was gradual in onset and progressive in nature. He had consulted elsewhere ten days back and had undergone laser treatment for the retina in the left eye. He was on oral acetazolamide and using topical brimonidine, timolol, and dorzolamide in the left eye.

On examination, his best corrected visual acuity was 6/9, N6 in the right eye and 6/60, N24 in the left eye. Intraocular measured 07mm Hg and 42 mm Hg in the right and left eye respectively with a Goldmann Applanation tonometer.

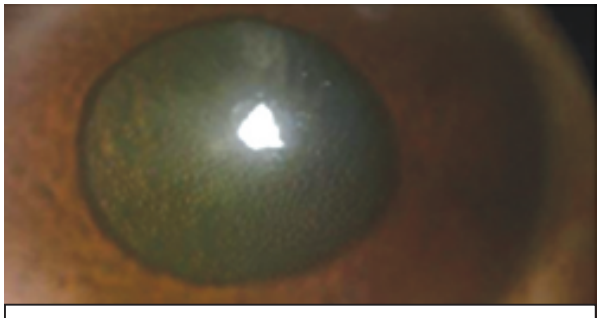

Fig1. Honeycomb Keratopathy afterNetarsudil use

Slit lamp examination (SLE) of the right eye was unremarkable and in the left eye ectropion uveae and neovascularisation of the iris were noted. Gonioscopy of the right eye revealed open angles while the left eye angles were found to be closed. The optic disc was found to be healthy in the right eye and the left eye showed an increased cup disc ratio. The retina had fresh laser marks and features of proliferative diabetic retinopathy (PDR) in both eyes.

A diagnosis of PDR in both eyes and neovascular glaucoma in the left eye was made. The patient was advised to continue all medications and in addition, topical Netarsudil 0.28% and bimatoprost 0.01% were added along with topical steroid and cycloplegic. The patient was reviewed the next day and Injection Ranibizumab was given intravitreal. That evening patient had skipped anti-glaucoma medications. The following day he was reviewed and SLE showed typical changes of honeycomb keratopathy. The patient was advised to discontinue Netarsudil eye drop while other medications were continued, and a lubricating eye drop was added. After ten days when the patient was reviewed again, the cornea had cleared completely, and the patient underwent two sittings of pan retinal photocoagulation.

Discussion:

This case had a very interesting observation where honeycomb keratopathy developed only after the application of a single drop of Netarsudil. In a case series published recently[3] it has been reported that all cases either had a corneal risk factor or a recent intervention that led to the development of corneal edema. In our case, there was no previous history of corneal disease. However, we do not have a corneal endothelial count to reaffirm that. Our patient had undergone an intravitreal injection Ranibizumab. Although intraocular inflammation is uncommon following anti-vascular endothelial growth factor (anti-VEGF) therapy it has been reported. In our patient, there were no visible signs of inflammation, but honeycomb keratopathy was observed only after the intravitreal injection. This supports the previous idea of intervention-related inflammation responsible for honeycomb keratopathy. To our knowledge, this is the first case of corneal reticular edema or honeycomb keratopathy following an intravitreal injection of anti-VEGF.

It is not clear how Netarsudil causes honeycomb keratopathy, but Rho kinase inhibitors act by disrupting the tight junctions and actin cytoskeleton of the corneal epithelium. This possibly allows the formation of epithelial bullae[4].

The addition of Rho kinase inhibitors to our anti-glaucoma armamentarium has definitely been a boon but clinicians should keep in mind the potential side effects. Since there is a paradoxical effect of Netarsudil on the cornea, further research is required to find out the exact mechanism by which the adverse effects on the cornea occurs.

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Case report

Early division of Cutler-Beard flap for a large lid tumour

Isha Agarwalla, Ramesh Agarwalla, Puja Kedia, Mohit Garg

Abstract:

Aim : We describe a variation here carried out for early vision restoration of the patient.

Method : Bridge flap was made in the conventional way, sutures were placed adequately. For early restoration of the vision, division of the flap was planned in 3 weeks. Single case was done by this technique with good post operative outcomes.

Result : The upper eyelid reconstruction was successfully done with the 2nd staged surgery carried out in 3 weeks. The patient had a good early visual recovery with a good functional and cosmetic outcome. There was no foreign body sensation and a good contour was also maintained.

Conclusion : This method provided the patient early recovery with good functional and cosmetic outcomes.

Keywords: vision restoration, early division, advancement flap.

Introduction :

Cutler beard is a well-established technique for reconstruction of large full thickness defects in upper eyelid. The method originally described in 1955 by Cutler and Beard, involves creation of advancement flap constituting of skin, orbicularis and conjunctiva. Tissue borrowed from lower lid alters the structure in a way that the tarsal support and Meibomian gland is lacking with damage of some fibres of orbicularis during the procedure.

Method:

The patient presented with large upper eyelid defect andtumour resection was carried out at Drishti Netralaya, India.Informed consent was obtained. The surgery was carried out in 2stages.

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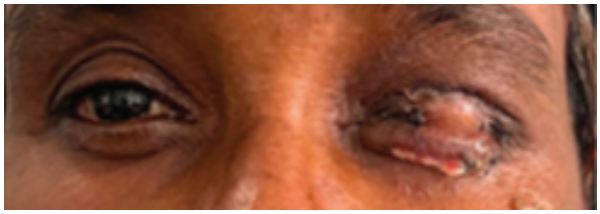
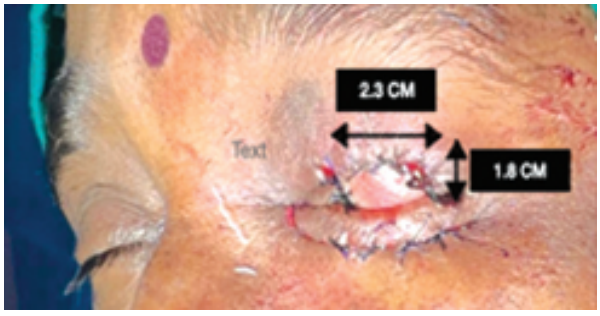
Surgical technique:

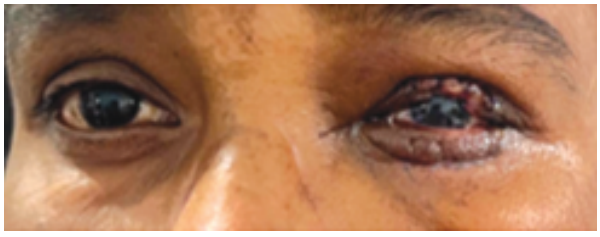
After the tumour of size 2 cm X 1.5 cm was excised with a 3mm surgical safety margin from the upper eyelid (Fig 1 & 2), a full thickness defect of 1.8 cm X 2.3 cm was created. Advancement flap from the lower lid was created leaving the lower lid tarsus intact. A bridge flap was created and the tissue was sutured in layers to the upper lid, anterior lamella to the anterior and

Fig 1 & 2: The tumour of size 2 cm X 1.5 cm was excised with a 3mm surgical safety margin from the upper eyelid



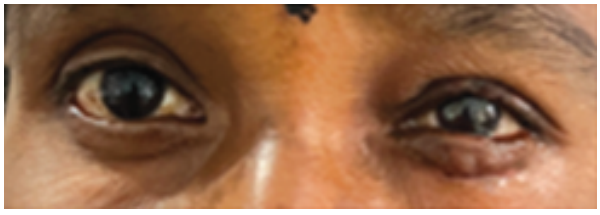


The patient was thoroughly evaluated every week.The 2nd staged separation surgery was done at 3 weeks(Fig 5 below).



Careful division was carried out and sutures were placed.

Result: The follow up was done weekly, 2nd stage surgery being carried out at 3 weeks. Postoperatively, patient was examined on 6weeks and 3 months. The mass sent for histopathology showed a cyst lined by stratified squamous epithelium containing keratinous material, with no evidence of malignancy. Tumour free margins were noted. Early separation showed early vision recovery and also good functional and cosmetic outcomes (Fig 6 below).



Post operative outcome :

Outcome	6 weeks	3 months
BCVA	6/12	6/9P
Foreign body sensation	Present	Present, but reduced
Eyelid closure	Adequate (100%)	Adequate (100%)
Upper eyelid notch	Absent	Absent
Unhealthy granulation tissue	Absent	Absent

Discussion: Cutler beard is a well-established procedure for restoration of full thickness defects in Upper Lid. It has advantages of using most autogenous and compatible tissue to restore the defect. Close anatomical approximation causes early tissue healing and thus allows early separation. Visual, cosmetic and functional outcomes can be restored. In defects of larger than 75% Mustarde's flap or Cutler Beard can be used (1). For reconstruction of upper lid, if lower lid tissue is used it has better compatibility and better healing as same anatomical, functional properties of tissues are present, thus better healing(2). Various complications can occur due to inappropriate healing or intra-operative surgical apposition techniques such as lid margin notch, necrosis while healing, and foreign body sensation (3). In our case, the patient had healthy surrounding tissue and after the biopsy results we decided on early separation.

Conclusion:

Cutler Beard is thus a good modality for reconstruction following large lid defects. Early division in healthy surrounding tissue shows promising result with better acceptance.

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Tear Substitutes - Current Perspectives

Srinivas K Rao, Sanjeev P Srinivas

Dry eye is currently an important problem in the Indian context and the increasing use of smartphones and computers has increased its prevalence in children and young people as well as the elderly. The DEWS II report in its definition of dry eye, implicates tear film instability and hyperosmolarity as the key factors in the onset and progression of this condition. However, while tear abnormalities play an important role in the pathogenesis of dry eye, the report also recognized the roles of concurrent meibomian gland dysfunction and inflammation. The concept of a vicious cycle of events which lead to and perpetuate abnormalities in the ocular surface in dry eye was also proposed by Badouin, in which various factors trigger the changes on the surface and if untreated, result in a chronic disease state.

The tear film has a complex anatomic structure, and its homeostasis is maintained by interplay of various neural, humoral, hormonal and other factors. Its chief functions are to provide moisture, comfort, lubrication, clear vision and antimicrobial protection. It also maintains the osmolar milieu that is favorable to the ocular surface epithelium, and subserves nutritive and trophic functions. The normal secretion, spread and removal of tears is termed tear film turnover and this helps remove noxious substances andmaintain the health and comfort of the ocular surface. When this delicate balanceis disturbed the patient can present with symptoms of discomfort – variously described as foreign body sensation, dryness, redness, burning, difficulty in opening the eye, light sensitivity, pain, itching, fatigue, tearing and blurred or fluctuating vision.

The impact of dry eye disease has been extensively studied and is reported to affect the physical and psychosomatic well-being of the patient. In terms of its impact on quality-of-life, a study has described it as being equivalent to angina.

It is also known to result in depression, anxiety, and sleep disturbances. The economic impact stems from loss of work days and the cost of ophthalmologist visits and treatment. The goals of management of this important condition are to promote lubrication and hydration, increase tear retention, reduce symptoms, protect the surface from hyperosmolarity, decrease inflammation, and maintain a healthy tear film to ensure clear vision. Eye drops remain the first line of management, and the terminology has changed over the years. Although the term – artificial tears has become popular, it has been suggested that this may be inaccurate because there is currently no commercial product that simulates the biologic and trophic functions of natural tears Hence is has been suggested that the term – tear supplement, may be more appropriate.

This is a generic term and more specific terminology include wetting agents that lubricate and have a limited residence time on the ocular surface; multiple action tear substitutes that improve the tear film, and have a limited interaction with the epithelium,

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and ocular surface modulators that promote cellular health and reduce inflammation. However, for the rest of this article, the term Tear supplement has been used to describe these products.

In general, these are electrolyte solutions with different buffers. They can vary in the composition and the presence and type of preservative, viscosity, duration of action, osmolarity and pH, and the presence of other additives. Among the various categories, astringents precipitate protein and clear mucus from the surface, demulcents are water soluble polymers that protect and lubricate, emollients protect and soften tissues and prevent drying, and humectants retain water and promote hydration. Buffers, electrolytes and other additives are considered as inactive ingredients.

Among the demulcents, the subgroups include cellulose derivatives like carboxy methylcellulose (CMC), hydroxyethyl cellulose (HEC), hydroxypropyl methyl cellulose (HPMC), and methyl cellulose (MC). Dextran 70 0.1%, and gelatin 0.01% have also been used. The polyols include glycerin, polyethylene glycol (PEG) 300 and 400, polysorbate, polyvinyl alcohol (PVA) and povidone. All of these serve to soothe inflamed mucous membranes and relieve pain.

Various inactive ingredients that are added to the above include HP guar, which is a bean protein that is a muco-mimetic and thickens and stabilizes the aqueous layer, sorbitol which is used in conjunction with HP guar to lower the viscosity in the bottle, hyaluronic acid (HA) that is a humectant, hypo-osmotic agent used to promote epithelial healing and reduce inflammation, and polyacrylic acid, which is similar to polyvinyl alcohol but has better viscosity. Emollients include lanolin, mineral oil, paraffin, petrolatum and white wax and these generally are used in ointments. They serve to lubricate, soothe and contribute to the oily layer, and help to seal in the moisture.

Among the cellulose derivatives, the most commonly used is CMC, which binds to cells, and increases viscosity and clearance times. HEC coats and protects the eye. HPMC crosslinks on the ocular surface to increase tear clearance times, while MC has to be used in conjunction with other agents as it is too viscous to be used alone. Dextran, a low molecular weight agent that increases the mechanical strength of the tear film, is also used in combination with other agents.PEG mimics mucin on the ocular surface to lubricate, protect and increase the viscosity, while propylene glycol is a humectant that can hold 3 times its weight in water. Glycerin, L-carnitine and erythritol are used to counter the hyperosmolar tear film that occurs in dry eye, while povidone is a lipid that thickens the existing oily layer of the tear film. PVA lowers the viscosity of other thicker agents. Thus, these additives help counter hyperosmolarity, promote epithelial healing, combat inflammation (HA and Trehalose), increase tear retention on the ocular surface, and more recently a nano emulsion of oil droplets have been added to supplement the lipid layer in the tear film.

An important aspect of these products is the preservative that is used to reduce the risk of microbial contamination in the bottle. These can include older detergents like benzalkonium chloride, polyhexamethylene biguanide, and ethylene diamine tetraacetic acid and newer agents like polyquad, chlorobutanol and sorbitol. Transient or disappearing preservatives include sodium perborate and stabilized oxychloro complex, which serve as a preservative in the bottle but when instilled in the eye, on contact with ultraviolet rays or the ocular surface enzymes, decompose into harmless elements like hydrogen, oxygen and water. Ionic buffering systems like Sofzia also behave in a similar manner, and there are unpreserved medications in unit dose containers, or in multi-dose containers that contain a complex cap design to ensure only one-way flow of the product and prevent ingress of pathogens.

The principles of use of tear supplements include the treatment of patient symptoms, preventing

symptom escalation, and dilution and removal of noxious agents and products of inflammation from the surface. Hence it is important that they be used at regular intervals during the waking hours, and in inflamed eyes, low viscosity agents are preferred to reduce the retention of deleterious substances on the eye. It must however be noted that these products do not treat the underlying causes of dry eye disease itself.

In patients with more severe disease, higher viscosity agents can be used as they have a longer retention time on the eye, while in those with mild disease lower viscosity agents are used to reduce blurring of vision. Gels and ointment are preferred for night time use to promote comfort on awakening. The ideal pH of these products should be 7.5 to 8.5 and if this is not maintained, burning on instillation can occur. If symptoms are not relieved despite the use of these agents 6 to 8 times a day, alternative strategies must be considered. These include tear preservation with punctal occlusion, tear stimulation with topical rebamipide and diquafosol, or oral pilocarpine and cevimeline. If inflammation is present, steroids, cyclosporine A, lifitegrast, tacrolimus and omega-3 fatty acids can be considered. Concurrent lid margin disease must be managed, and underlying systemic conditions may need an internist consultation. PROSE lenses, autoserum tears, vitamin supplementation and nerve growth factor can be used in severe cases. Surgical measures like lateral tarsorrhaphy, lid margin mucous membrane grafts, and labial mucosal gland transfer can help in advanced cases.

When considering the efficacy of tear supplements, all of them treat patient symptoms, and some treat the underlying pathology, but none treat the etiology. When using them it is important to have protocols that can initiate treatment in mild, moderate and severe cases. Considering the various changes on the ocular surface and the variety of tear supplements available, knowledge of the primary actions of these agents can help mix-and-match the treatment in a given patient, using a mesh approach. Another useful concept in planning treatment in dry eye is the step ladder approach. In those with mild disease treatment is started with one agent and then others are added as required. However, in those with more severe disease, it may be necessary to initiate treatment with multiple agents to rapidly manage symptoms and reduce ocular surface damage. As the condition responds, the agents can be gradually reduced to reach an optimal regimen.

General principles in choosing an agent can include demulcents in aqueous deficiency, humectants or oil emulsion containing preparations in lipid deficiency, muco-mimetics in mucin deficiency, osmoprotectants in hyperosmolarity, and HA in epithelial damage. Additional factors to consider include the viscosity of the drop, the presence of additives, the need for ointments, and frequency of use. Frequent monitoring of the condition to assess improvement and a good rapport with the patient in this chronic disease can be helpful. Finally, with the multitude of products available currently, the serious practitioner of dry eye disease management may be best served by regularly using a particular brand of tear supplement – for the various agents available. This will allow a better understanding of the pros and cons of the product as well as its efficacy, which can make monitoring of treatment outcomes easier.

In conclusion, dry eye disease is here to stay, and tear supplements are currently the mainstay of treatment for this condition. There is a need to understand their composition and properties and to use them rationally. However, given the complex nature of dry eye disease, it may also be important to understand that the treatment does not end with tear supplements alone.

The topic was presented at OSACON 2022, Guwahati — Ed.

Perspective: Managing myopia is beyond mere single vision correction!

Pavan K. Verkicharla

Myopia has slowly started to get attention in India and has become one of the "hot" topics of dogmatic debate amongst eye care professionals. In spite of it being remained as one of the most common refractive conditions in children and young adults for about half a century now, only recently, myopia is considered as a public health concern of the 21st century.[1] The astounding numbers - 5 billion to have myopia, 1 billion at the risk of having high myopia-related complications worldwide[2] – and more recent predicted prevalence of myopia from India, indicating 48% of children living in urban regions to have myopia by the year 2050, is definitely of concern.[3] Considering that myopia affects an individual both directly and indirectly due to associated ocular complications, in addition to impact on psychological and social health, the prevention and reduction in rate of myopia progression is the need of emergency.

In India, myopia shows anti-climactic/massive variations, with the prevalence ranging anywhere from as low as 2% in rural regions to about 30% in urban regions. While East Asian countries experienced the peak of myopia prevalence a few decades ago, myopia in the urban Indian population seems to be following such a path if no action is initiated soon. The current digital and indoor-centric ecosystem and the limited time spent outdoors are likely to lead/act as a catalyst for the growing epidemic of myopia in India. Our research work investigating the pattern of progression in 6984 myopes indicated that myopia in Indian children progresses/advances by half a dioptre per year (-0.48 ± 0.01D) and 13% of children had rapid myopia progression (>1D/year) who are at risk of developing sight-threatening myopia related complications.[4] With regards to pathologic myopia, our findings based on the large sample size of 29,592 myopes indicate that myopia related pathologic lesions occur in 5 out of 100 individuals with myopia and do not necessarily depend on either the age or the severity of myopia.[5] These lesions are clearly seen even in children and those with low degrees of myopia.

Based on the current and predicted trends in myopia prevalence and its related pathology, yes, it is important that a lot of eye care practitioners get into the immediate business of combating myopia. But how? Well, we now have multiple myopia control treatment options. However, before we get there, it is wise to remember the most common sentence written in myopia-related research publications: "unfortunately, the cause for myopia still remains unclear." Therefore, it also means that one maybe should not blindly provide some fancy treatment without knowing the underlying cause or triggering factor in that specific individual (child/adult). A holistic approach to examination, monitoring, and managing any individual with myopia is the need of the hour and the best way to combat myopia.

One must understand that the aetiology of myopia development and progression is multi-factorial, involving complex interactions among nature (genes), nurture (environment) and optics, and structures of the eye. While various myopia control treatment options (both optical and pharmacological)

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are effective, it is worth noting that there are a few "non-responders" or "poor-responders" displaying treatment resistance to any of the available treatments. And it appears that like shooting in the dark may lead to a large number of non/poor responders in one's myopia management practice. First, we need to "manage" myopia, instead of just correcting it with mere single vision lenses. Thus, the statement - managing myopia or myopia progression entails more than just prescribing singe vision spectacles. Second, there are multiple options to control myopia progression. It is preferable that the prescription of myopia control treatment in any mode to counteract myopia progression should be decided on a case-to-case basis, considering all the possible myopiogenic "X"-factors. Third, regularly monitor all the risk factors, and finally, spend enough time in educating/counselling parents and children about myopia and the need for myopia control strategies.

Research is linked with practice and more so in myopia – where we know little if anything in one of the largest sea that currently has more questions than the answers. India and the other countries in the Indian sub-continent stand special for myopia – we did not see the peak in prevalence rate yet, we have geographical regions/pockets with very less prevalence of myopia, there is huge diversity in our population, the education, the environment, culture, and lifestyle are very diverse. To corresponds with this diversity, the myopia prevalence in the India also varies dramatically within a few kilometers range. This feature/characteristics of our Indian sub-continent can help us understand myopia better. It implies that there is need for more myopia practitioners and many more myopia researchers are required in India to contribute to this science of mysterious myopia.

All we need now is the "far-sighted approach" to tackle this "near-sighted problem".

The Myopia Mantra to remember: Master — Measure — Monitor — Manage!

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Brief communication

The dry eye related disorders

Lily Gayan

Dry eye disease is a disabling disorder that affects visual function as well as the quality of life of a person. It encompasses the loss of ocular surface haemeostasis that causes tear film instability, hyperosmolarity and inflammation of ocular surface. In current scenario of ageing population and increasing environmental factors it is becoming even more prevalent. Dry eye is not a trivial complaint. The symptoms cause significant discomfort and substantially reduce the sufferer's quality of life.

Dry eye disease is defined as symptomatic or through clinical diagnosis. Dry eye disease is a common condition among middle aged &older people. Prevalence of dry eye would go along with the fall in androgen levels that is also occurring at this time of life and that causes a lack of inflammationsuppression. Hormone replacement therapy does not alter the incidence of dry eye symptoms. Besides these factors there are other factors which also play a role in development of dry eyes like (a) age dry syndrome effects 75% of people over age 65. Tear volume decreases from age 18 as much as 60% by age 65 (b) hormonal changes cause decrease tear production brought on pregnancy, lactation, menstruation and menopause (c) medication that can cause dry eyes are antibiotics, blood pressure medication, antidepressants and over the counter vasoconstrictor such as visine, antihistamines, birth control pills (d) computer use causes most people to blink less frequently (about 7 times per minute vs a normal rate of around 22 times/ min) .This lead to increase in evaporation along with the fatigue and eye strain associated with staring at a computer monitor. Any task requiring a great deal of concentration can result in decreased blink rate lead to dry eyes. Dry eye can be worsened by low relative humidity like office e-environment, Air conditioned car, airplane cabins and extreme hot and cold weather. Other factors that exacerbate dry eye disease include long term contact lens use, refractive surgeries such as lasik, television watching and prolonged reading provoke symptoms of dry eye.

Allergic conjunctivitis is no longer seasonal or acute, affected by vehicle exhaust and other pollutants. Regarding dry eye disease several risk factors have been proposed including systemic diseases environmental factors, contact lens wear, topical and oral medications as well as refractive surgery. Dry eye disease can be debilitating, degradation of visual acuity can have an impact on many ordinary activities of daily living such as reading, driving, and viewing computer screen. It may be associated with burning, gritty-sandy sensation, dry mouth. But in ocular allergy patient will be complaining of itching, lid swelling, redness and tearing.

Tear contain just the right amount of natural components. A shortage of tears or tears that lack everything they need can cause the tear breakdown causing dry spots to form on the cornea. That causes the symptoms of dry, sensitive eyes-irritated gritty feeling eyes that burn, feeltired, or are generally uncomfortable.Surprisingly, dry eye can sometimes

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cause excessive tearing in an attempt to keep the eyes surface wet. But these tears still lack needed components,so dry eyes remain a problem.Dry eye commonly effects older adults, especially women. As we age the body produces less fluid, including tears.

Adverse environmental conditions such as dry air, smog, smoke and wind can aggravate the condition. Other allergies, vitamin deficiencies and arthritis can cause tear film problem. Dry eye symptoms are considered by patient as effects of overworking, tiredness,exhaustion.The blink reflex renews the tear film by delivering aqueous and lipid to the tear film and sweeping away debris. The blink interval is about seconds under normal condition. Tear film is typically stable for about 10 seconds. Tears are normally evaporated or forced out through nasolacrimal duct in the inner corner of the eyes on blinking. The main factors precipitating dry eyes are (1) decreased tear production (2) Increased tear evaporation.

Tear film instability is caused by alterations in lipid layer functioning and the quantity, quality, and availability of tear fluid. It causes the symptoms of dry eye and is a starting point of inflammation. Ocular surface irritation, adverse environmental factors, friction and nerve impairment can cause epithelial malfunction. This plays a key role in continued tearfilm instability, increasing inflammatory reaction and reduced protection of nerve endings. Epithelial response to external stimuli causes the initial inflammatory reaction. Prolong exposure to an inflammatory stimulus further elicits immunogenic adaptive reaction that make the disease chronic. Eyelid notches and thickened and rounded lid margins affects the shape and function of the menisci. This adversely affects the tear film distribution and lipid layer spreading. Further, any impairment or malfunctioning of lid associated gland affect the composition of tear lipids and act as possible source of inflammation and infection.

Dry eye syndrome is the most frequent patient complain as the common symptoms, like foreign body sensation burning sensation ,intolerance to droughts and winds are considered by patients as effect of overworking, tiredness,exhaustion,they often ignored as a problem worth referring to an ophthalmologist. Dry eye syndrome is commonly associated with systemic inflammatory processes and like most eye diseases, it is often related to health conditions in the rest of the body, including dryness of other mucous membranes such mouth,vagina,and joints.

The core mechanism of dry eye are driven by tear hyperosmolarity and tear film instability. Tear hyperosmolarity causes damage to the surface epithelium by activating a cascade of inflammatory events at the ocular surface and release of inflammatory mediators into tears. Epithelial damage involves cell death by apoptosis, a loss of goblet cells, and disturbance of mucin expression leading to tearfilm instability. Loss of normal mucins at the ocular surface contributes to symptoms by increasing frictional resistance between the lids and globe. The major causes of tear hyperosmolarity are reduced aqueous tear flow resulting from lacrimal failure or increased evaporation from tear film.

Meibomian gland dysfunction/ blepharitis and nerve impairment must be controlled for complete ocular surface treatment. Lid hygiene should be maintained. Topical or systemic antibiotics, anti-inflammatory agents and tear substitutes should be used. Medium -viscosity formulation tear substitutes are beneficial in treating meibomian gland dysfunction/blepharitis. The frequency of instillation should be consistent (4-6 times /day). Lid hygiene by means of warm /hot compresses and medicated wipes are essential to control meibomian gland dysfunction/blepharitis.Omega-3 derivatives and vitamin A as a topical application improves ocular surface health. In dry eye disease treatment

epithelium protection is important for Interrupting the vicious cycle in dry eye disease in dry eye disease .Trehalose a naturally occurring non reducing sugar, plays a role in anhydrobiosis, confers resistance to desiccation and high osmolarity and is thought to control inflammation, hence is valued as a possible therapeutic tool in dry eye disease. Hyaluronic acid is used in tear substitution, increases viscosity, improve retention time and optimizes ocular surface hydration and lubrication.

The choice of therapy for dry eye disease may be determined by the severity of the condition. Mild cases may be successfully managed with artificial tears applied up to four times daily. In moderate disease where damage to the ocular surface is limited to certain zones, use of unpreserved artificial tears upto 12 times per day and an unpreserved lubricating eye ointment at bed time may be needed.

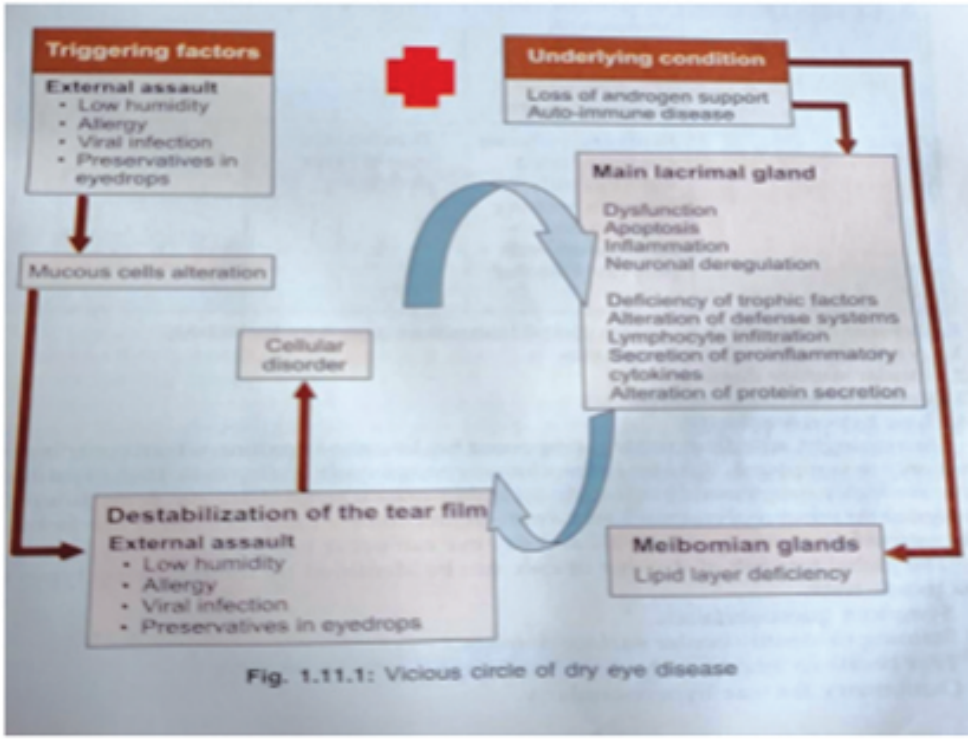

Fig. 1.11.1: Vicious circle of dry eye disease

Brief communication

Ishihara Colour vision test

Mousumi Saikia

Colour vision is that attribute of the sense of the sight which provides an appreciation of differences in the physical composition of wavelengths ( ) of the light that excite the retina. Most colour vision tests use non-spectral colours, i.e. colours composed of > 1 (different colours). The principle behind the different colour vision tests are as follows-

1. Colour Confusion
2. Colour Arrangement.
3. Colour Mixing
4. Colour Matching
5. Colour Identification

λ

The **Ishihara test** is a color perception test for red-green color deficiencies. Figure & background colour are chosen so that colour deficient persons get confused while normal ones able to discern easily. The test consists of a number of colored plates, called **Ishihara plates**, each of which contains a circle of dots appearing randomized in color and size. Within the pattern are dots which form a number or shape clearly visible to those with normal color vision, and invisible, or difficult to see, to those with a red-green color vision defect, or the other way around. It was named after its designer, Dr.Shinobu Ishihara, a professor at the University of Tokyo, who first published his tests in 1917. A figure or symbol in 1 colour is placed on the background of other so that they are isochromatic for colour defect person. The full test available in 16, 24 &38 Plates, but the existence of a deficiency is usually clear after a few plates. 38 plates edition is often commercially available. It is used as screening test to identify inherent colour defect (protan and deuten defect) but also permit diagnosis of type and severity with symbols (numerals) or wandering trails. The plates make up several different test designs:

- **Demonstration plates**: 1 & 38 for demo.

-**Transformation plates**: individuals with color vision defect should see a different figure from individuals with normal color vision (2-9).

-**Vanishing plates:** only individuals with normal color vision could recognize the figure. A Red-Green deficient person does not see any number (10-17).

-**Hidden digit plates:** only individuals with color vision defect could recognize the figure. A normal trichromat sees no number at all (18-21).

-**Diagnostic plates**: intended to determine the type of color vision defect (protanopia or deuteranopia) and the severity of it (22-25). A normal trichromat reads the two digit number correctly. But strong protanomalous or protanopic person sees only the second digit and strong deuteranomalous or deuteranopic person sees only the first digit. Mild protanomalous or mild deuteranomalous observers see both the digits, but protanomalous observers see the second digit brighter and clearer than the first digit while deuteranomalous observers see first digit

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brighter and clearer than the second digit.

-Tracing Plates: These plates are used to detect Red-Green defects in children and illiterate patients. These plates use tracing rather than naming the number or letter (26-38).

To conduct the test the minimum visual acuity should be greater than 6/60. The plates are held 75 cm. from the subject and tilted so that the plane of the paper is at right angles to the line of vision with the best corrected visual acuity. The numerals which are seen on plates are stated, and each answer should be given without more than three seconds delay. The test should be perform monocularly first, then binocularly. It is not necessary in all cases to use the whole series of plates. Plates 12, 13 and 14 may be omitted if the test is designed merely to separate the color defectives from those with normal color appreciation. The first 6 plates are used for screening purpose only.

The plates are designed to be appreciated correctly in a room which is lit adequately by daylight (25 foot candle without glare/ Std. daylight/ Macbeth Easel lamp/ 100W bulb with Bluish gelatin filtered specs). The introduction of direct sunlight or the use of electric light may produce some discrepancy in the results because of an alteration in the appearance of shades of color. When it is convenient only to use electric light, it should be adjusted as far as possible to resemble the effect of natural daylight.

Number of Plate	Normal Person	Person with Red-Green Deficiencies				Person with Total Colour Blindness and weakness
1	12	12				12
2	8	3				U
3	6	5				U
4	29	70				U
5	57	35				U
6	6	2				U
7	3	5				U
8	15	17				U
9	74	21				U
10	2	U				U
11	6	U				U
12	97	U				U
13	45	U				U
14	5	U				U
15	7	U				U
16	16	U				U
17	73	U				U
18	U	5				U
19	U	2				U
20	U	45				U
21	U	73				U
		Protan		Deutan		
		Strong	Mild	Strong	Mild	
22	26	6	(2)6	2	(2)6	22
23	42	2	(4)2	4	(4)2	23
24	35	5	(3)5	3	(3)5	24
25	96	6	(9)6	9	(9)6	25

Analysis:

- As assessment of the readings of plates 1 to 21 determines the normality or defectiveness of colour vision.
- If 17 or more plates are read normally, the colour vision is regarded as normal.
- If only 13 or less than 13 plates are read normal, the colour vision is regarded as deficient.
- However, in reference to plates 18, 19, 20, and 21, only those who read the numerals 5, 2, 45, and 73 and read them easier than those on plates 14, 10, 13 and 17 are recorded as abnormal.
- lt is rare to find a person whose recording of normal answers is between 14~16 plates. An assessment of such a case requires the use of other colour vision tests, including the anomaloscope.

		Red green blindness			
		Protan		**Deutan**	
Plate Number	**Normal** Person	**Absolute** (Protanopia)	**Partial** (Protanomalia)	**Absolute** (Deuteranopia)	**Partial** (Deuteranomalia)
26 & 27	A(along purple & red lines)	A(along purple line)	A(both lines but purple line is easier to follow)	A(only red line is traced)	A(both lines are traced but red is easier to follow)
Plate Number	**Normal Person**	**Person with Red green** Deficiencies		**Person with Total Colour** Blindness and weakness	
28 & 29	U	A		U	
30&31	A (Bluish-Green line)	U		U	
32&33	A(Orange Line)	U		U	
34&35	A(Bluish-Green & Yellowish-Green line)	A (Blush-green& purple)		U	
36&37	A(Purple & Orange)	A (purple & Blush-green)		U	
38	A	A		A	

The letter "U" shows that the plate cannot be read. The numerals in parenthesis show that theycan be read but they are comparatively unclear.

A: Able to trace the winding lines between 2 X's

U: Unable to trace the line connecting the two X's or follow the line

( ): Along the colour mentioned

It is important that the book of test plates should be kept closed, except during use, because undueexposure to sunlight causes a fading of the color of the plates. Tracing curves must be soft in order to preventscratching.

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Brief communication

Non-Surgical Management of Congenital Anophthalmia and Microphthalmia

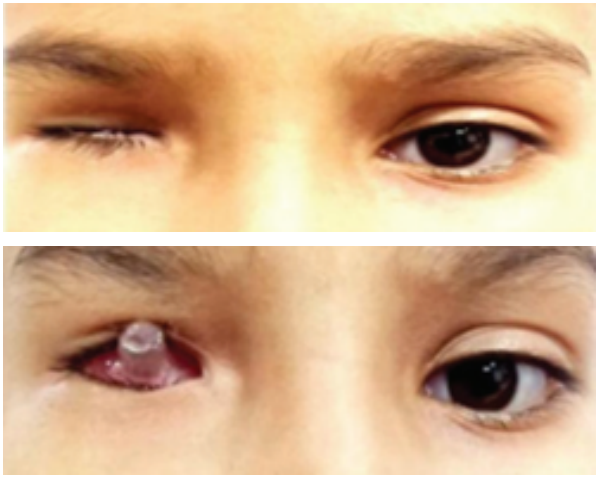
Jico Gogoi

Congenital Anophthalmia is the complete absence of the eyeball while congenital microphthalmia is an underdeveloped or small eye since birth. The combined birth prevalence of these conditions is up to 30 per 100,000 population, with microphthalmia reported in up to 11% of blind children.[1]

The above mentioned conditions may be isolated or part of a syndrome with other associated abnormalities. It can be caused by inherited conditions or by exposure of the developing foetus to the rubella virus or to drugs including alcohol, thalidomide, retinoic acid, hydantoin. [2]

The small or absent eye associated with congenital anophthalmia or microphthalmia is therefore generally accompanied by reduced growth of the soft tissues of the orbit, the eyelids, the bony orbit and surrounding face. In unilateral cases, this significantly distort facial symmetry if left untreated. In bilateral cases, there may be minimal asymmetry but the effects on facial structure can be quite apparent.

While managing children with microphthlmia the primary step is determining the visual potential of the eye. If the eye has at least modest visual potential, treatment of the orbit and eyelids must never occlude the pupil which may be done by incorporating clear pupil into the conformers and



prosthesis.

For children with severe microphthalmia or anophthalmia who have no visual potential, the aim of treatment is to stimulate hard and soft tissue growth of the orbit to reduce any asymmetry of the face as much as possible as the child grows into adulthood [3, 4]. It is important to start the management of the condition as soon as possible after birth as the growth of the fellow eye will mostly occurs during the first 3 years of life, most rapidly in the first year. The first line of management is the insertion of the custom designed socket expanding conformer in the socket. These conformers support theeyelids in the natural position as well as stimulate orbital and adnexal growth.

These customised conformers/expanders made of high grade PMMA (polymethyl methacrylate) is designed as a series of increasing size which is periodically replaced in the socket in regular

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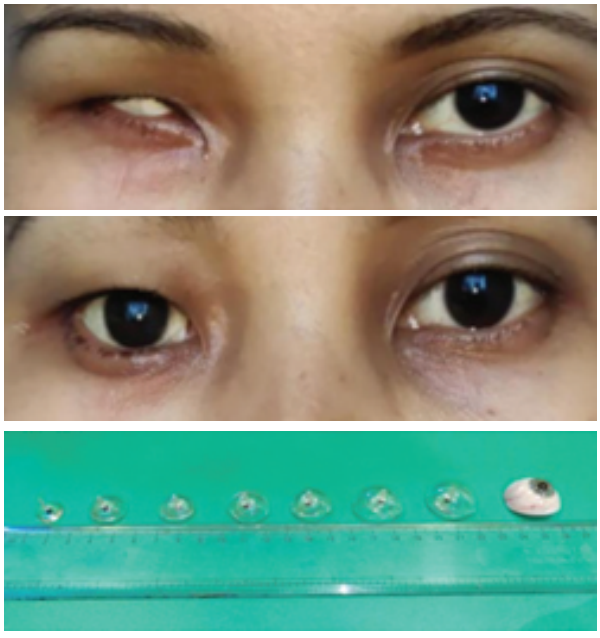

intervals. Initially they are replaced monthly or earlier and then at longer intervals until the socket is ready for a custom designed ocular prosthesis.

The important feature in these patients is the size of the eyelids and palpebral aperture and measuring the horizontal size of the width from medial to lateral canthus is a simple way to monitor the progress [5].

In severe anophthalmia or microphthalmia, in which the socket does not retain these conformers, it is designed with a stick, which should be taped by generating a pressure perpendicularly to the surface of the socket. Another way will be to hold the conformer in place is by a simple tarsorrhaphy.

The results of this technique is highly encouraging & rewarding. Sometimes if the child is not able to come for regular follow ups, then a series of such increasing size conformers are given to the parents/ guardian after teaching them the proper insertion and removal. They can easily replace the present size with the next larger size at home once the earlier one becomes lose or pops out. This way it is very cost effective and also ensures very less losing patient to follow ups.

Other technique is using a conformer made of hydrogel material. When dehydrated, this conformer is small and solid, on hydration, if expands and becomes a firm gel [3]. The main limitation is that these kind of implants hydrate rapidly, reaching maximal size in a short span of time and is quite expensive.

The technical complexities of the balloon expander Orbital implants, which expands on injection of saline, has limited to the experimental use present day.

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Brief communication

Community awareness on low vision: A sneak peek into the reality

Nilanjana Ghosh

Low vision is a major public health problem worldwide. Low vision has been defined as " a vision problem that makes it hard to do daily activities and cant be fixed through glasses, contacts or standard treatments ". Though no stigma or taboo it still remains a grey zone in terms of health services registered or presented. The patients largely go unnoticed by the health system because of lack of available and accessible services present at doorstep. Ignorance of patient also is a contributing cause along with lack of knowhow of community regarding the same[1].

Various studies have indicated low vision as a separate identity with etiology ranging from genetic predisposition, age related degenerations, glaucoma, diabetes, cancer of eye and brain injury. Low vision disability charts help in reiterating the diagnosis. However albinism and , retinitis pigmentosa and few other causes are known to cause pediatric low vision also. Various ophthalmologists practice care specific to them and have set up chambers with various low vision aids.

The low vision aids are in three categories namely optical, non optical and electronic. Non Optical aids are aids which make activities of daily living accessible but do not use lenses like optical aids do. Magnifying spectacles, Telescopes, Video Magnifiers and some methods like Increasing house lighting, reducing gl;ares, special low vision devices are also affordable. These aids help in not only restoring normalcy in real life settings but also create sense of well being among them, instilling hope among others[2]. Low vision aids need no special training to be used and ophthalmologists, medical doctors and trained technicians can do justice to the cause at even primary and secondary health care set up.

Studies have found positive effect of age and illiteracy on low vision. Chennai study reported .97% to be having low vision[3]. Preventive interventions also stay like wearing sunglasses, eating vegetables , avoiding smoking , healthy lifestyle and maintaining 20-20-20 rule of every 20 minutes to look 20 feet in front of you every 20 seconds. Need hence arises for community awareness. From the patient side these causes being genetic, a screening and timely intervention is the key to an anticipated improvement. Health communication among families, routine screening and alert about any change in vision can help seek care at initial stages. Moreover peers support or knowledge of any affected will help in building quality circles and seeking care. Any identified family or community with low vision can seek assistance or special care from the provisions made.

Effective service utilization depends on promptness to seek care alongside optimal service delivery of health care staff with liberally allocated resources for the cause and pledged government support. From health system side the awareness and capacity building of staff at primary health care set up can go a long way. Opening special visit days by

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ophthalmologists in secondary health care system can lo pave way[2]. Their initiatives in awareness generation at community level after community sensitization at regular intervals with success stories and lived experiences are a mandate to address the issue. Opening specialized branches and encouraging research for the same can also help in opening new dimensions.

The foremost focus lies on addressing the issue and preventing its propagation along with rehabilitating the ones affected with customary aids. Moreover life skills need to be taught to cope with daily lives. Low vision aids increases sense of coherence and this salutogenic endeavour will go a long way in improving quality of life if appropriately implemented sensitive to requirements f community and customized to needs.

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Letter to the editor-1

Dear Editor,

Keratometry after keratoplasty

Keratoplasty is a common replacement procedure for corneal opacities/ pathology not amenable to medical management. In most situations of corneal pathology needing keratoplasty, early lenticular change is also present. In such a clinical scenario, a triple procedure is carried out. However development of cataractous changes over a period of time following keratoplasty is not uncommon necessitating a planned cataract surgery at a later stage.

Biometry, especially keratometry poses challenges because of irregular corneal surface and curvature post keratoplasty, especially in penetrating keratoplasty (PKP) and anterior lamellar keratoplasty (ALK). Keratometry is much more predictable in Endothelial Keratoplasty as the anterior corneal surface is left untouched

Manual Keratometry **:** Suture removal should be done at least one year prior if possible. Mader et al has shown that astigmatic errors became stable, with less than one D of change between successive examinations within six months after suture removal [1]. It has also been seen that the axis of astigmatism determined by keratometry and autokeratometry showed the strongest correlation with the subjective manifest refraction axis, if at all refraction is possible in a patient with cataracts.[2]It may be helpful to puta drop of lubricant to stabilizes the ocular surface and aid in recording the K values. Average of multiple readings may have to be taken.

Topography **:** Topography, like keratometry, is best done after at least six months of complete suture removal. The topography of corneas after penetrating keratoplasty is highly variable and can present broadly in of the following types— prolate bow tie; oblate bow tie; mixed prolate and oblate bow tie; asymmetric; and steep/flat [3]. The overall simK values derived from the topography give a more reliable reading than keratometry

The IOL power can be determined by using both standard and corneal topography-derived keratometry using the SRK/T formula. The accuracy of biometric measurements is higher for optical methods than for ultrasonic methods. In ultrasound biometry (UB), there are more operator-dependent factors that are not present with optical methods. However UB remains the preferred method for IOL calculation in dense cataracts. In specific and demanding situations, as in certain post-PK cases, the standard IOL calculation remains insufficient. New mathematical algorithms are necessary that take into account the specificity of corneal shape, the anterior chamber depth and the clear corneal curvature.

Achieving the expected refraction post cataract surgery in a keratoplasty patient remains a challenge. Adequate pre operative counseling needs to be done regarding the IOL to be used and also to apprise patient of significant residual refractive error following the cataract surgery

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OSA Awards 2016 - 2021

49th Annual Conference of OSA - Jorhat 2016
(Awarded in Guwahati in 2017)

WINNERS

- **Case Presentation**

  Title: - "Functional Nasolacrimal Duct Obstruction Due To Atonic Lacrimal Sac: A Special Case." - Dr. lva Rani Kalita

- **Dr. Haren Hazarika Award for Best Paper in Anterior Segment**

  "Amniotic Membrane Transplantation In Acute Ocular Burn."- Dr.Nilakshi Baruah

- **Best Paper in Posterior Segment**

  "A Study Of Relationship Between Severity Of Diabetic Retinopathy & Sub-Clinical Hypothyroidism." -Dr. Shobhana Phukan.

- **Best Video**

  "Intraocular Calisthenics: The Road Less Travelled." -Dr. Shaurabh Sarma.

- **K.R. Dutta Award** : - Shobhana Phukan

- **Quiz Sri Sankaradeva Netralaya-**

  Dr. Prabhjot Kaur Multani

  Dr. Saurabh Deshmukh

  Dr. Sumegha Tomar

***Ophthalmological Quiz for PG's was introduced for the first time in OSA.**

50th Annual Conference of OSA, Guwahati 2017
(Awarded in Silchar in 2018)

WINNERS

- **Dr. Haren Hazarika Award for Best Paper In Anterior Segment:**

  Dr. Mayur Dutta Bharali : Rhexis Size Reproducibility Wih Verion

- **Best Paper in Adnexa & others:**

  Dr. Haimanti Choudhury : Vision Therapy In Headache

- **Best Paper in Posterior Segment:**

  Dr. Ronel Soibam : Efficacy of Modified Inverted Internal Limiting Membrane Flap Technique For The Treatment Of Chronic Large Idiopathic Macular Hole, Presenting To A Tertiary Eye Care Center in NorthEast India.

- **K R Dutta for overall Best Paper:**

  Dr. Ronel Soibam : Efficacy of Modified Inverted Internal Limiting Membrane Flap Technique For The Treatment Of Chronic Large Idiopathic Macular Hole,Presenting To A Tertiary Eye Care Center in NorthEast India.

- **Best Poster :**

  Dr. Sushmita Paul : Clinical Profile Of Neovascular Glaucoma –A Retrospective Analysis Of Cases From A Tertiary Eye Care Institute

- **Best Video :**

  Dr. Jayanta Kumar Das : Swimming Of Thalazia After Bisection Of Cyst Excised From Adjacent To lacrimal Sac. See it, believe it or not?

- **Quiz Winners : Sri Shankardev Netralaya**

  Dr. Fazil Khurrum,

  Dr. Krati Gupta,

  Dr. Saurabh Deshmukh

51st Annual Conference of OSA, Silchar, 2018
(Awarded in Guwahati -2019)

WINNERS

- **Dr. Haren Hazarika Award for Best Paper in Anterior Segment –**

  Dr. Henal Javeri : "Experience With Keratoprosthesis At A Tertiary Eye Care Center"

- **Best Paper in Posterior Segment –**

  Dr. Himadri Chowdhury : "Scleral Buckling: Return Of The King"

- **KR Dutta for overall Best Paper:**

  Dr. Himadri Chowdhury : "Scleral Buckling: Return Of The King"

- **Best Poster:**

  Dr. Sushmita Paul : Steroid Induced Glaucoma: A Case Of Preventable Childhood Blindness

- **Best Video-**

  Dr Jayanta Kumar Das : Temporal Muscle flap In Exenterated Socket: Air Support To Ground Shoulder Against Cosmetic Disfigurement

- **Winner of Ophthalmological Quiz : Team RIO, Guwahati**

  Madhura Madappady

  Dr. Anshuman Saikia

  Dr. Farhana Rahman

52nd Annual Conference of OSA, Guwahati 2019
(Awarded Certificates Online 2020)

WINNERS

- **Dr. Haren Hazarika Award for Best Paper in Anterior Segment**

  Dr. Sheesham Singh : Title of Paper: Tear Volume And Ocular Surface Changes Before And After Upper Eyelid Blepharoplasty.

- **Best Paper in Posterior Segment:**

  Dr. Manabjyoti Barman : Challenges of Retinoblastoma Yet To Meet -10-year Retrospective Analysis At A Tertiary Care Centre in NE India.

- **KR Dutta Award for Overall Best Paper:**

  Dr. Sheesham Singh :

  * Dr. Manabjyoti Barman did not compete for the KR Dutta Award and allowed Dr. Sheesham Singh to Win It.

- **Best Poster:**

  Dr. Sristi Shreya Malakar : Childhood Primary Orbital Rhabdomyosarcoma- A Challenge In Management.

- **Best Video:**

  Dr. Ronel Soibam : Tackling The Traction: Surgical Pearls On Managing Complex Diabetic Tractional Retinal Detachment.

  Dr. Himadri Choudhury : Vitrectomy for Proliferative Diabetic Retinopathy: Tips and Tricks.

- **Winner of Ophthalmic Quiz : Team Silchar Medical College**

  Dr. Saura Kamal Dutta

  Dr. Tanveer Ahmed

  Dr. Shibashis Deb

53rd Annual Conference of Ophthalmological Society of Assam (Online), 2020

WINNERS

Dr. Bikram Dam : Demystifying The Role Of Smoking On Ocular Surface and Tear Film With Impression Cytology & Clinical Evaluation – A Novel Study In A Tertiary Eye Care Centre Of North East India.

54th Annual Conference of Ophthalmological Society of Assam (Hybrid), Dibrugarh 2021 (To be Awarded in Guwahati, 2022)

WINNERS

- **Best paper**

  Dr. Alankarita Hazarika (AMCH, Dibrugarh) : "Acute Ocular Complications In Patients Undergoing Radiotherapy For Head And Neck Cancers"

- **Best poster**

  Dr. Matthew Savio (AMCH, Dibrugarh): "A Case Of Neuromyelitis Optica (NMO)Resulting in Optic Atrophy- A Diagnostic Mishap"

- **Best Video**

  Dr. Ronel Soibam (Eye Care Centre, Guwahati) :"Facing The Adversity Of ROP STAGE 4 &5"

55th Annual Conference of OSA
Guwahati 2022

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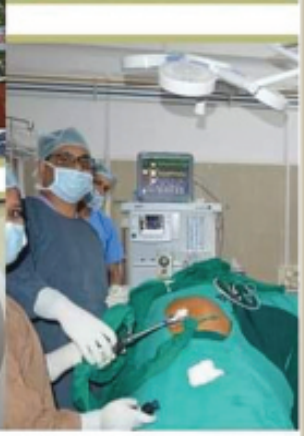

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