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Clinical Profile of Ocular Injuries Associated with Mid-Facial Trauma—A Threat To Blindness

Dr. Sucheta Parija

The anatomical location of orbits and the globe are vulnerable to various alterations due to maxillofacial trauma. The incidence of ocular injuries varies from 0.8% to 67%. The severity of injuries can vary from a simple subconjunctival hemorrhage to devastating conditions causing blindness like optic neuropathy and globe rupture. Both prospective and retrospective studies indicate 20% serious ocular damage. Orbital floor fractures have been associated with 40% prevalence of ophthalmic complications.

Eye injuries in association with midfacial trauma can pose diagnostic difficulties, as care for life threatening injuries will be the immediate priority taking care of airways and vital systems. Some ophthalmic injuries are apparent; however other potentially blinding complications can be missed, unless actively looked upon. Inadequate care or delayed referral can result in blindness, with its attendant social and medico-legal implications. The incidence of blindness as reported from various studies is around 3%. Hence, ocular examination is mandatory for every patient who has sustained midfacial trauma, severe enough to cause a fracture.

This study was designed to describe the spectrum of ocular involvement associated with midfacial injuries and to analyze the visual outcome.

MATERIALS AND METHODS

This was a retrospective study undertaken at Regional Institute of Ophthalmology at SCB Medical College, Cuttack, Odisha from March 2008 to May 2010. The medical records of 280 patients with mid-facial trauma were reviewed. 80 patients had ocular involvement and had a detailed ophthalmic examination. The variables recorded were age, sex, cause of injury, type of facial fracture, type of ocular trauma, and type of management received. Details about visual acuity, significant diplopia and probable cause of blindness were also recorded. Radiological investigations like CT scan of brain, maxillofacial and orbit or MRI of face and 3D reconstruction of facial fractures were done in all cases. B-scan of eye was done where necessary. Apart from suturing of lacerations and airway management, patients were also managed by multidisciplinary approach.

RESULTS

In this study of 280 cases of midfacial trauma, 80 cases had ocular involvement. The incidence of ocular involvement was 28.6%. Gender distribution showed 66 cases (82.5%) of male and 14 cases (17.5%) of female. There was a male
preponderance (82.5%) and commonly affecting 16-30 years age group (46.3%). The age ranged from 3 to 75 years. Young adult males (20 to 40 years) were most vulnerable to these types of injuries 54 cases (67.5%) as shown in Table-1.

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>Male nos.</th>
<th>Male %</th>
<th>Female nos.</th>
<th>Female %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>4</td>
<td>5.0</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>16-30</td>
<td>31</td>
<td>38.8</td>
<td>6</td>
<td>7.5</td>
</tr>
<tr>
<td>31-45</td>
<td>22</td>
<td>27.5</td>
<td>4</td>
<td>5.0</td>
</tr>
<tr>
<td>46-60</td>
<td>7</td>
<td>8.8</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>61-75</td>
<td>2</td>
<td>2.5</td>
<td>1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

The causes of maxillofacial injuries sustaining ocular injuries are shown in Table-2. Road Traffic Accidents (RTA) were the most common cause of ocular disorders in 43 cases (53.8%) followed by assaults in 19 cases (23.8%).

<table>
<thead>
<tr>
<th>Causes</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic accident</td>
<td>43</td>
<td>53.8</td>
</tr>
<tr>
<td>Assault</td>
<td>19</td>
<td>23.8</td>
</tr>
<tr>
<td>Fall from height</td>
<td>7</td>
<td>8.8</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>6</td>
<td>7.5</td>
</tr>
<tr>
<td>Sports</td>
<td>5</td>
<td>6.3</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

The ocular manifestations observed in 80 cases of maxillofacial injury sustaining multiple injuries are shown in the bar graph below. Periorbital ecchymosis and subconjunctival haemorrhage (76.5%) was the most common presenting feature followed by diplopia in 36.5%. Patients with comminuted malar fracture suffered from severe ocular disorder (23.8%). In blow-out fracture cases diplopia was observed in 17.5%. Visual acuity < 6/60 was found in 38.8%. Blindness was attributable to traumatic optic neuropathy in 2.5% and ruptured globe in 8.8% in our study.

**DISCUSSION**

An association between facial fractures and visual impairment has been well documented. Several papers report that the highest incidence of severe ocular injury occurs in patients with midfacial fractures caused by RTAs, although some of the population studied had low seatbelt usage. Our study showed most common cause was RTA (61.3%) and 51.1% had not used seatbelts.
The ocular involvement with midfacial injuries was 28.6% in our study. Al-Qurainy et. al. found that most patients had evidence of eye injuries, and 27% sustained a moderate to severe eye injuries. The fracture sites most frequently associated with severe ocular injuries are orbital (mainly involving the orbital floor, followed by the lateral wall), as demonstrated in this study and in previously published research.

The optic nerve was the most frequently injured of the cranial nerves associated with midfacial fractures and the most common cause of poor visual prognosis and blindness. The incidence of optic nerve injury in patients with facial fractures was 2.1%. Blindness was caused by traumatic neuropathy in 2.5% in our study, similar to that reported in the series of midfacial fractures by Al-Qurainy et. al. The International Optic Nerve Trauma Study showed that one third of the patients had a final visual acuity of hand movement or worse in the affected eye.

In our study six patients of indirect Traumatic Optic Neuropathy (TON) received megadoses of intravenous methylprednisolone within 8 hours of trauma. Four patients underwent surgical treatment of facial trauma. Four patients showed partial or complete visual recovery while two patients of direct TON had no visual recovery.

Al-Qurainy et. al. (1991) described 363 patients with a total of 438 midfacial fractures with loss of vision in 2.2%, similar to the study by Kallela et. al. (1994) 2.3% and by Bossert et. al.6 (1994) 3%. Our study reported blindness rate of 11.3%, while a higher rate of blindness was stated by Asher et. al.7 (1998) as 22%.

The literature displays a consensus that an accurate assessment must precede the surgical treatment of midfacial ocular fractures. Identification of ocular lesions is a crucial medico-legal issue so that responsibility for a permanent visual loss is not ascribed to the treatment of maxillofacial fractures as reported by Jamal et. al. (2009).

In conclusion vision threatening ocular damage was frequently associated with comminuted midfacial fractures and orbital floor fractures being mainly caused by road traffic accidents. A higher incidence of blinding injuries warrants a prompt ophthalmologic examination which should be mandatory.
REFERENCES

Study of Clinical Profile and Etiology of Ocular Trauma in Tertiary Center

**Dr. K H Partani, Dr. Khushbu Bhattad**

Though eyeball is a fairly well protected structure in our body, injuries to the eye are commonly found and are the commonest cause of attendance for ophthalmic emergency. It is a major and under-recognized cause of disability and ocular morbidity. Besides loss of vision, earnings and productivity; it increases the cost to society because of increased health care spending. However, nearly 90% of eye injuries can be prevented by relatively simple measures. Despite its public health importance, there is relatively less data on demographic and clinical profile for ocular trauma, especially from developing countries.

Aim of the present study was designed to analyze the demographic profile, epidemiology, clinical characteristics of ocular trauma at a tertiary care center in central India for designing and implementing improved methods of prevention.

**MATERIALS AND METHODS**

This was prospective study done on 629 patients reporting with history of ocular trauma from June 2009-December 2011 at our tertiary eye center in central India. A complete history of the mishap including cause, nature
and circumstances of the injury was noted. In addition, the demographic data of each patient including address, literacy status, and occupation was also recorded. Time gap between injury and presentation to the hospital was also taken into the consideration. Patients residing in a place with no district hospital were categorized as rural. The detailed ophthalmic work up of all the patients including visual acuity, slit lamp examination and fundus examination was carried out. Ultrasonography was used whenever hazy media prevented fundus evaluation. Intraocular pressure was measured in all eyes except in fresh open globe injuries. Gonioscopy was done in all patients with closed globe injuries, except in eyes with corneal edema or hyphema in whom gonioscopy was done at follow up visit. X ray, CT scan and MRI were done in cases of intraocular foreign body. MRI was not used where intraocular foreign body was suspected to be of metallic in nature. Standardized ocular trauma classification given by ocular trauma society of America was used to grade all injured eyes at initial examination.

RESULTS
Out of 629 patients, maximum (n=213, 34%) were in 21-30 year age group. Males were more commonly affected than females.

Right eye (n=365, 58%) was more commonly injured. 95% (n=597) patients had not worn eye protector during trauma. 44% (n=277) patients were farmers by occupation. 67% (n=421) patients were from rural population. 8% were under alcohol influence at time of trauma.

Maximum patients (n=185, 29.4%) had injury at work place. 45% (n=283) cases presented 24 hours after trauma.
Trauma with vegetative matter (n=153, 24.3%) was most common cause of injury. Conjunctiva was most commonly involved tissue (n=255, 40.5%) and optic nerve had minimum (n=7, 1.2%) injuries. RAPD was present in 9 (1.4%) patients. 69(11%) patients had ocular infection after ocular trauma.

Closed globe injuries are more common than open globe injuries. Their distribution is as given in tree diagram.

Maximum (n=403, 64.7%) patients had Zone C1 injuries while only 3(0.47%) patients had Zone P2 injury. 61% (n=384) patients having vision better than 20/40 are categorized as Grade 1 and only 1.2% (n=8) patients had Grade 5 Injury with no PL.
DISCUSSION

In this study, the incidence of ocular trauma was significantly higher among males due to their more exposure to outdoor activities. It was found that maximum number of patients were in the age group of 21-30 years. This is in accordance with the study by Shukla and Khanna\(^3\), Canavan et. al.\(^4\) and Olurin et. al.\(^5\) who also found the maximum incidence in the age group of 21-30 years.

Occupational hazards remain the most common risk factor of ocular injuries in India. Trauma from vegetable matter was the most common cause.

95% patients had not worn eye protector during trauma. The Indian market is basically glass market and very few people opt for plastic glasses in their spectacles or sunglasses which could have prevented these injuries.

79.5% of injuries were closed globe injuries which is significantly higher than open globe injuries. Duke Elder\(^5\) has also reported 75% of injuries as closed globe injuries.

Among closed globe injuries, most patients had extra ocular Foreign Body (28.7%). However Caroline et. al.\(^4\) have reported these injuries to be 22.4%.

Among open globe injury, penetrating injuries to Cornea (47%) were more common than sclera (17.8%), largely due to its exposed situation.

This study emphasizes the importance of classifying and grading ocular injuries according to the new ocular trauma classification. New ocular trauma classification is now widely accepted and has been assessed for its prognostic significance. The best corrected visual acuity and relative afferent papillary defect are the strongest predictors of long term visual outcome.

Our study indicates that there is significant burden of ocular trauma in Indian population. The treatment even with experienced ophthalmologist didn’t significantly influence final visual outcome and makes it imperative that preventative eye care programs should consider ocular trauma in population as priority.

In conclusions, ocular injuries were more common in young males. Most of the injuries were work related and occurred due to carelessness. Prevention is most effective treatment of trauma. Educating patients about bad prognosis of ocular injuries and importance of eye protector is important to handle these menaces.

REFERENCES

Optic Disc Mimicking Glaucomatous Disc in Advanced Age-Related Macular Degeneration

Dr. Kavita Dhabarde, Dr. Mona Deshmukh, Dr. Snehal Bonde Chaurasia, Dr. Bhushan Ghodke

Age related macular degeneration (AMD) is the leading cause of irreversible blindness in individuals of 55 years and older. The disease adversely affects quality of life and activities of daily living, causing many affected individuals to lose their independence in their retirement years.

According to various population-based studies, the prevalence rate of AMD is 9.2%, while the 5 year incidence rates of AMD were 2.5%, 6.7% and 10.8% for individuals who were 65, 70 and 75 years of age respectively.

Age: The prevalence of moderate to advanced AMD doubled with each decade after age 60.

Gender: No overall difference in the frequency of AMD between men and women.

The advanced forms of AMD associated with visual acuity loss are divided into non-neovascular atrophic (dry) type, and neovascular (wet) type.

In atrophic AMD, gradual disappearance of the retinal pigment epithelium (RPE) results in one or more patches of atrophy that slowly enlarge and coalesce to form the natural end-result of AMD – “the geographic atrophy(GA) of RPE”. It accounts for 12-21% of the cases of legal blindness attributed to AMD. After the age of 70 years, prevalence of GA feature rises sharply.

We thus, study the optic disc morphology and its association with geographic atrophy in patients with advanced AMD.

Aim of the study is to describe appearance of optic disc in patients with advanced age-related macular degeneration (AMD).

MATERIALS AND METHODS

It was a retrospective comparative study conducted in a tertiary eye care centre, 30 patients presenting in a period of 2 years, from March 2010 to March
2012 with clinical features of advanced AMD (defined as geographic atrophy or disciform scar) in at least one eye were enrolled.

**Inclusion criteria:** Patients with normal intraocular pressure, refractive error ≤ -6D, patients with no signs of glaucomatous optic neuropathy were included. Patients with known history, visual field defects and diagnosed cases of glaucoma, high myopia were excluded from the study group.

The assessment of optic disc morphology was done by digital fundus photography and glaucomatous optic nerve damage was assessed by Fourier Domain-Optical Coherence Tomography (FD-OCT). Optic disc evaluation and OCT measurements were then compared with fellow eyes with relatively smaller areas of AMD. p-value of less than 0.05 was considered as significant.

**RESULTS**

The total number of patients included in our study was 30. The mean age of patients was 73.6 ± 12.14 years. The male: female ratio was 1:1. Optic disc evaluation by fundus photography revealed that larger area of geographic atrophy or disciform scar in one eye due to AMD is related to the morphology of optic disc of the same eye that was likely to be classified as glaucomatous disc by clinical evaluation with a significant p-value of 0.015 as compared to fellow eye with smaller area of AMD. Similar findings was confirmed by OCT imaging analysis of both the eyes with a p-value 0.030 (3.30 in more severe AMD Vs. 2.75 in fellow eye). Also, larger areas of AMD was correlated with higher Cup: Disc ratio (P =.022) and smaller neuroretinal rim (P=.022).

**DISCUSSION**

Geographic atrophy is a permanent end-result of AMD. We studied retrospectively, the appearance of optic disc in cases of severe AMD. With 1 DD area of geographic atrophic patch there was proportional increase in the cupping of the optic disc as demonstrated by fundus photography and OCT. The size of optic disc was 3.30 in eyes with relatively larger areas of atrophic patch as compared to the size of optic disc 2.75 in the fellow eye with smaller area of atrophy. The cup: disc ratio was also higher with consequent thinning of the neuro-retinal rim in the more diseased eye as compared to the fellow eye. OCT measurements of the optic disc and peripapillary area thus confirms an apparent morphology of glaucomatous disc in the more diseased eye with larger atrophic patch. Thus both digital fundus imaging and OCT provides a better association of a large disc in the same eye with larger areas of AMD.

In conclusion, Optic disc in advanced AMD with larger geographic atrophic scar can mimic glaucomatous disc. Hence, the disc in these patients can be misdiagnosed as glaucomatous optic neuropathy. Thus a careful optic disc evaluation is mandatory in patients with advanced stage of ARMD.
Predicting Visual Potential in Patients Undergoing Corneal Transplantation by using Retinal Acuity Meter

Dr. Doula Thengil, Dr. Samar Basak

The accurate prediction of postoperative acuity in eyes with corneal diseases and cataract remains a challenge to clinicians.

In this study, we measure the accuracy of a new potential vision tester, the RAM, to predict post-operative RAM acuity, distance acuity, in eyes undergoing different types of corneal transplantation.

Materials and Methods

Prospective non-comparative study in 22 eyes of 16 patients, who underwent for different types of corneal transplantation consisting of pseudophakic bullous keratopathy (posterior chamber intraocular lens)-7, corneal oedema with PCIOL-2, corneal oedema in Fuchs’s Endothelial Dystrophy with cataract-7 bullous keratopathy in Fuchs’s Endothelial Dystrophy with cataract-2, lattice dystrophy -2 corneal opacity 1, failed therapeutic penetrating keratoplasty with complicated cataract-1. Parameters taken are preoperative and postoperative best corrected visual acuity, preoperative and postoperative retinal acuity, meter acuity. Patients undergoing Descemets stripping endothelial keratoplasty post operative parameters taken after 3-4 months and in penetrating keratoplasty, Deep Anterior Lamellar Keratoplasty taken after 6 months. Patients having post-operative complications are excluded (Graft related).

The Retinal acuity Meter consists of brightly illuminated near card with letter indexed from 20/20 to 20/200 in 9 increments, frame having multiple small aperture pinhole with near correction add. Battery operated, hand held and held at 40 cm, is available with Snellen letters, numbers, and E-chart characters.
The Panoramic Pinhole expands the field of view during pinhole testing with the Retinal Acuity Meter. It provides the patient with a side by side comparison of current vision and prospective vision.

RESULTS

Male: Female =11:5 and Age: 27-80 years 19(86%) eyes had DSEK with/without PCIOL. 2 optical pk 1 DALK Preoperative BCVA was <1 to 0.7 in 16 (72.7%) eyes, 0.5 to 0.6 6 eyes and RAM acuity 0.2-0.3 in 15(68.1%) eyes 0.4 to 0.5 5 eyes with no improvement in 2 eyes. Postoperative BCVA was 0.2-0.3 in 17 (77%) eyes 0.4 to 0.5 in 3 eyes and <1 in 2 eyes. Postoperative RAM acuity was 0.2-0.3 in 17(77%) and 0.4 in 3 eyes no improvement in 2 eyes. Out of 22 eyes 18 (81.8%) eyes had good prediction. In 4 (18.2%) eyes - visual acuity remained same, reduced or no improvement, later diagnosed as macular pathology. (Diabetic CSME, BRVO, ARMD)

Out of 22 eyes 18(81.8%) eyes had good prediction. In 4 (18.2%) eyes – visual acuity remained same, reduced or no improvement, later diagnosed as macular pathology.

DISCUSSION

The optical principles are brightly illuminated near card, multiple small aperture pin holes near add and panoramic pin hole.

The Retinal Acuity Meter (RAM) is a handheld device used to assess macular function behind the media opacities caused by cataract or posterior capsular opacification and corneal diseases

Preoperative potential acuity assessment may help surgeons give a more accurate estimate of postoperative acuity.

In turn, predicting visual acuity may decrease the number of patients who are disappointed with their surgical results—or possibly avoid unrewarding surgeries.

The RAM device is especially useful in patients who have more than one cause of decreased vision.

In a patient with cataract plus a macular disease (e.g., diabetic retinopathy, epiretinal membrane, macular degeneration), it is often hard to determine whether the visual loss is due to the cataract alone or as part of the macular disease

In conclusion, Retinal Acuity Meter can be good tool to predict postoperative visual potential in patients undergoing corneal transplantation where macular examination is not possible. Instrument is handy and easy to use.
Comparison of Symptoms and Signs of Dry Eye – Do they Correlate?

Dr. Charudatt Chalisgaonkar, Dr. Charudatt Chalisgaonkar, Dr. P C Dwivedi, Dr. M K Rathore, Dr. Pankaj Choudhary, Dr. Vaishali Khare

Dry eye syndrome (DES) is a multifactorial disease of the tears and ocular surface that results in discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. Various diagnostic tests are available that address different forms of dry eye due to its multifactorial causation. A combination of various subjective and objective measurements is often used to determine the presence and/or severity of dry eye in an individual. It has been recognized, particularly in mild and moderate dry eye, that diagnostic tests are prone to disagree and give conflicting results. In the present study we assessed the correlation between the individual diagnostic tests and dry eye symptoms.

MATERIALS AND METHODS

Patients presented with symptoms suggestive of dry eye at Ophthalmology OPD, GMH, Rewa (M.P) from January 2011 to December 2011 were included in study. 250 patients participated in the study after obtaining informed consent.
All subjects completed McMonnies questionnaire (MQ)\(^1\) consisting of 14 questions and a possible score of 0–45, with a score of >14 consistent with a dry eye diagnosis as previously recommended. Assessment of the tear secretion was done using Schirmer test, a reading of less than 10 mm at 5 minutes was judged to indicate dry eyes. Stability of tear film was assessed by tear film break up time (TFBUT), value of <10 seconds was taken as an indicator of dry eye. A biomicroscopic examination of the Meibomian glands, lids, conjunctiva and tear film was performed at a slit-lamp examination to assess signs of ocular surface abnormality, inflammation and severity of Meibomian gland dysfunction (MGD). The grading scale was categorized according to Foulks and Bron.\(^2\) Grade 2 or above were regarded as positive for the presence of ocular surface abnormality. Chi-square test was used as test of significance to determine the difference between the proportion of patients diagnosed by each test and symptoms as assessed by McMonnies questionnaire. For comparison with symptoms the results of worst eye for each test was considered in each patient.

RESULTS

The mean age of the total 250 subjects recruited was 42 years and ranged from 20–75 years. There were 124 men and 126 women. The number of subjects diagnosed as dry eye within this study is showed in Table 1.

The clinical data for all other diagnostic tests performed for all subjects are shown in Table 2 and Table 3.

The proportion of patients diagnosed by TBUT and MGD was found to be related to MQ (p=0.2016 and p=0.087). There was no statistical correlation between number of patients diagnosed by Schirmer test and other biomicroscopic signs with that diagnosed by MQ.

DISCUSSION

In our study, a significant correlation was found between certain tests assessing dry eye, in particular Meibomian gland dysfunction, TBUT and MQ. No correlation resulted between symptoms of dry eye and Schirmer test and other biomicroscopic signs. These results were in accordance with various previous studies.\(^3\)\(^-\)\(^5\) Very few subjects tested demonstrated a significantly reduced tear volume as measured by the Schirmer test, indicating that our study cohort did not fall within the spectrum of aqueous deficiency.

Assessment of patient symptoms is usually considered invaluable as a diagnostic aid for dry eye. This study adhered to the original MQ often considered to be the most widely used since its inception. MGD potentially has a significant role in destabilizing the tear film possibly as a result of alterations in fatty acid composition. TBUT is considered as one of the
Table 1: Comparison of dry eye diagnosis based on individual test

<table>
<thead>
<tr>
<th>Individual diagnostic test</th>
<th>Diagnosed with Dry eye (n=250)</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>McMonnies Questionnaire (test score &gt;14)</td>
<td>113</td>
<td>45.2%</td>
</tr>
<tr>
<td>Schirmer test (&lt; 10 mm at 5 min)</td>
<td>28</td>
<td>11.2%</td>
</tr>
<tr>
<td>TBUT (&lt;10 sec)</td>
<td>97</td>
<td>38.8%</td>
</tr>
<tr>
<td>Meibomian gland Dysfunction</td>
<td>85</td>
<td>34.0%</td>
</tr>
<tr>
<td>Conjunctival signs</td>
<td>54</td>
<td>21.4%</td>
</tr>
<tr>
<td>Tear film debris</td>
<td>46</td>
<td>18.4%</td>
</tr>
<tr>
<td>Lid margin</td>
<td>55</td>
<td>22.0%</td>
</tr>
</tbody>
</table>

Table 2: Symptoms of dry eye as assessed by McMonnies questionnaire.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>N</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning</td>
<td>62</td>
<td>24.8%</td>
</tr>
<tr>
<td>Itching</td>
<td>135</td>
<td>54%</td>
</tr>
<tr>
<td>Pain / discomfort</td>
<td>90</td>
<td>36%</td>
</tr>
<tr>
<td>Blurring</td>
<td>95</td>
<td>38%</td>
</tr>
<tr>
<td>Grittiness</td>
<td>113</td>
<td>45.2%</td>
</tr>
<tr>
<td>Dryness</td>
<td>82</td>
<td>32.8%</td>
</tr>
</tbody>
</table>

Frequency of symptoms

| Sometimes | 159 | 63.6% |
| Often     | 67  | 26.8% |
| Constantly| 24  | 9.6%  |

Intensity of symptoms

<table>
<thead>
<tr>
<th>Score</th>
<th>N</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>133</td>
<td>53.2%</td>
</tr>
<tr>
<td>3-4</td>
<td>89</td>
<td>35.6%</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

Table 3: Biomicroscopy scores for the assessment of the lids and lid margins, conjunctiva and tear film debris in 250 subjects

<table>
<thead>
<tr>
<th>Meibomian gland dysfunction</th>
<th>Lid and Margin</th>
<th>Conjunctiva</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythema</td>
<td>Swelling</td>
<td>Erythema</td>
</tr>
<tr>
<td>None (grade 0)</td>
<td>91</td>
<td>85</td>
</tr>
<tr>
<td>Mild (grade 1)</td>
<td>74</td>
<td>120</td>
</tr>
<tr>
<td>Moderate (grade 2)</td>
<td>48</td>
<td>37</td>
</tr>
<tr>
<td>Severe (grade 3)</td>
<td>37</td>
<td>4</td>
</tr>
<tr>
<td>Very severe (grade 4)</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>
important diagnostic test as it is reduced in nearly all forms of dry eye but has been criticized due to concerns about its reproducibility and variability between normal subjects on different days.

In conclusion, as evident from the results a number of individual testing methods displayed a different and conflicting diagnosis of dry eye. In the absence of an available diagnostic gold standard, assessment of patient symptoms is an invaluable diagnostic aid for dry eye. McMonnies questionnaire is useful instrument for screening of patients with symptoms suggestive of dry eye. TBUT, Schirmer test and various biomicroscopic test are useful for etiological diagnosis of dry eye.

REFERENCES

Clinical Evaluation of Dry Eye using Mcmonnie’s Questionnaire

Dr. Aditya Rege, Dr. Varsha Kulkarni, Dr. Neelam Puthran, Dr. Tejaswini Khandgave

Dry Eye Syndrome (DES), also known as Kerato Conjunctivitis Sicca (KCS) is a multifactorial disease of the tears and the ocular surface that is due to reduced tear production or excessive tear evaporation which results in discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. A strong correlation between symptoms and diagnostic test results is reported. Various questionnaires have been widely used in population based studies for screening the dry eye patients and to assess the severity of dry eye and its effect on the life style. Two validated questionnaires are the McMonnies Dry eye Questionnaire used to screen patients for the
possibility of dry eye disease so that the index of suspicion for those at risk is raised and therefore further clinical evaluation is then done by Dry eye tests and the Ocular Surface Disease Index (OSDI) which grades the severity of dry eye. Several diagnostic tests are used to assess the quantity, quality and functioning of various layers of tear film and diagnose the sub type and severity of dry eye dry eye. The commonly used tests are Schirmer’s, Tear Film Break Up Time (TFBUT), ocular surface staining with vital stains like Rose Bengal and Lissamine green, Meibomian Gland Dysfunction (MGD). Dry eye syndrome is very common affecting the quality of life. Various population based studies have been done to find out the prevalence and the magnitude of the problem. The prevalence reported ranged from 7.8% to 57.59%. The variation might be because of the variability of sampling techniques, geographical variations and lack of standardization of diagnostic criteria used. Further very few studies have reported subtype based prevalence.

MATERIALS AND METHODS

This study was conducted to find out the subtype based prevalence of dry eye using McMonnies Dry eye Questionnaire along with clinical dry eye tests and to study the specificity and sensitivity of the clinical dry eye tests used for evaluation of dry eye.

Aim of the study is to clinically evaluate Dry Eye in a tertiary health centre.

Objectives
1. To determine the prevalence of dry eye.
2. To determine the subtype based prevalence of dry eye.
3. To correlate McMonnies questionnaire with Dry eye tests results.
4. To study the specificity and sensitivity of clinical tests for dry eye.

The prospective, non randomized, cross sectional study was carried out in a tertiary health centre from September 2011 to February 2012. Institutional ethics committee approval was obtained prior to commencing the study. Study included all subjects of both the sexes above 18 years of age attending Ophthalmology OPD. Patients having active ocular infection, on topical medications and who had undergone intraocular or extra ocular surgery in past 6 months were excluded from the study. Individuals were enrolled in the study after taking a due informed consent for both, participation in the study as well as for any subsequent publication of data from the study. For basic screening, all patients were given to fill the McMonnies questionnaire. The score ranged from 0 to 45. The individuals having McMonnies score greater than 14.5 were evaluated further for Dry Eye diagnosis. The symptoms and history of each patient was noted in detail. The subjects then underwent a detailed ocular examination and following Dry Eye tests namely, Meibomian
Gland Dysfunction (MGD), Tear Film Break Up Time (TFBUT), Rose Bengal Test, Lissamine Green Test, Schirmer’s Test.

Schirmer’s test with/without TFBUT positive was considered as Aqueous Tear Deficiency (ATD), positive Rose Bengal and Lissamine Green staining test was considered as Mucin Layer Deficiency, Meibomian Gland Dysfunction along with TFBUT positive was considered Lipid Layer Anomaly. Data was captured on a standardized proforma. Results were tabulated and statistically analyzed using Chi Square test. A p-value of <0.005 was considered statistically significant. Considering Schirmer’s test as standard, specificity and sensitivity of each test was calculated.

RESULTS

This hospital based study was done on 2424 subjects (1000 males, 1424 females) who were enrolled during September 2011 to February 2012. All of them were asked to complete McMonnies Questionnaire. Score greater than 14.5 was noted in 585 (24.13%) subjects including 185 out of 1000 (18.50%) males and 400 out of 1424 (28.08%) females. Out of these, 572 (97.7%) subjects were diagnosed to have dry eye on the basis of clinical tests, whereas no test was positive in 13 (2.72%) subjects.

The prevalence of dry eye using McMonnies Questionnaire was 14.54% (56 out of 385) in males and 24.03% (149 out of 620) in females below 40 years of age. A definitive increase in prevalence with age was noted in both the sexes above 40 years including 20.97% (129 out of 615) of the males and 31.21% (251 out of 804) of the females. After applying Chi square test for independence p-value obtained was 0.01, which showed a significant association between the age and sex distribution.

McMonnies score between 15 and 16 was noted in 88 out 585 (15.04%) subjects. The score between 17 and 22 was recorded in 482 (82.39%) subjects, while only 15 (2.56%) subjects showed a McMonnies score above 23.

![Figure 1: Sex-wise distribution of population screened](image1.png)

![Figure 2: Distribution of McMonnies score (above 14.5)](image2.png)
Table 1: Age-wise distribution of dry eye

<table>
<thead>
<tr>
<th></th>
<th>Male screened</th>
<th>&gt;14.5</th>
<th>Female screened</th>
<th>&gt;14.5</th>
<th>Total screened</th>
<th>&gt;14.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-40</td>
<td>385</td>
<td>56</td>
<td>620</td>
<td>149</td>
<td>1005</td>
<td>205</td>
</tr>
<tr>
<td>41-80</td>
<td>615</td>
<td>129</td>
<td>804</td>
<td>251</td>
<td>1419</td>
<td>380</td>
</tr>
</tbody>
</table>

Table 2: Results of dry eye tests

<table>
<thead>
<tr>
<th>Dry Eye Tests</th>
<th>Positive Subjects</th>
<th>Out of 585 (%)</th>
<th>Out of 2424 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schirmer’s</td>
<td>91</td>
<td>15.55%</td>
<td>3.75%</td>
</tr>
<tr>
<td>Tfbut</td>
<td>458</td>
<td>78.29%</td>
<td>18.89%</td>
</tr>
<tr>
<td>MGD</td>
<td>196</td>
<td>33.50%</td>
<td>8.08%</td>
</tr>
<tr>
<td>Rose Bengal</td>
<td>158</td>
<td>27.00%</td>
<td>6.51%</td>
</tr>
<tr>
<td>Lissamine Green</td>
<td>57</td>
<td>9.74%</td>
<td>2.35%</td>
</tr>
</tbody>
</table>

Table 3: Correlation of the Test Results With McMonnies Score

<table>
<thead>
<tr>
<th>McMonnies Score</th>
<th>Total</th>
<th>Schirmer’s</th>
<th>TFBUT</th>
<th>MGD</th>
<th>Rose Bengal</th>
<th>Lissamine Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-16</td>
<td>88</td>
<td>11.86%</td>
<td>66.94%</td>
<td>25.42%</td>
<td>25.42%</td>
<td>12.71%</td>
</tr>
<tr>
<td>17-18</td>
<td>192</td>
<td>12.06%</td>
<td>72.73%</td>
<td>28.01%</td>
<td>15.83%</td>
<td>5.83%</td>
</tr>
<tr>
<td>19-20</td>
<td>179</td>
<td>13.33%</td>
<td>84.10%</td>
<td>30.00%</td>
<td>19.45%</td>
<td>11.28%</td>
</tr>
<tr>
<td>21-22</td>
<td>111</td>
<td>23.64%</td>
<td>87.16%</td>
<td>39.18%</td>
<td>45.00%</td>
<td>10.81%</td>
</tr>
<tr>
<td>23-24</td>
<td>15</td>
<td>52.63%</td>
<td>89.47%</td>
<td>63.15%</td>
<td>63.15%</td>
<td>15.78%</td>
</tr>
</tbody>
</table>

Table 4: Sub type based prevalence

<table>
<thead>
<tr>
<th>Sub Type</th>
<th>Total</th>
<th>% out of 585</th>
<th>% out of 2424</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous Tear Deficiency</td>
<td>109</td>
<td>18.63%</td>
<td>4.49%</td>
</tr>
<tr>
<td>Lipid Layer Anomaly</td>
<td>356</td>
<td>60.85%</td>
<td>14.68%</td>
</tr>
<tr>
<td>Mucin Layer Deficiency</td>
<td>158</td>
<td>27.00%</td>
<td>6.51%</td>
</tr>
<tr>
<td>MGD</td>
<td>196</td>
<td>33.50%</td>
<td>8.08%</td>
</tr>
</tbody>
</table>

Tear Film Break Up Time Test was positive in maximum number of subjects (78.29%) followed by Meibomian Gland Dysfunction test (33.50%) and then by Rose Bengal test (27.00%), Schirmer’s Test (15.55%) and Lissamine Green test (9.74%). All the subjects showing a positive Lissamine Green test showed a positive Rose Bengal test. 13 subjects (2.72%) tested negative for all the dry eye tests.
The prevalence of a positive Tear Film Break Up Time test was higher in all McMonnies score ranges, but there was increase in the number of subjects having positive Meibomian Gland Dysfunction test and Rose Bengal staining in scores above 23. A diagnosis of Aqueous Tear Deficiency was made when only Schirmer’s Test and Tear Film Break Up Time as well as Schirmer’s test was positive. The prevalence of Aqueous Tear Deficiency was 18.46% in cases of dry eye and over all prevalence in population screened was 4.49%. 61.36% of dry eye subjects had Lipid Layer Anomaly which was diagnosed when Tear Film Break Up Time and/or Meibomian Gland Dysfunction test was positive. The overall prevalence in population studied was 14.68%. Mucin Layer Deficiency was diagnosed when Rose Bengal and/or Lissamine Green stain was positive. It was seen in 27.00% of dry eye subjects and over all prevalence was 6.51%.

There was overlapping of various subtypes indicating multilayer involvement in 24 (4.10%) subjects who had all four tests positive. Considering Schirmer’s Test as gold standard, sensitivity and specificity of each test was calculated. The sensitivity of Tear Film Break Up Time was 68.85% and specificity was 78.32%. The sensitivity of Meibomian Gland Dysfunction was 32.71% and specificity was 30.60%. Rose Bengal showed a good sensitivity of 85.8% but poor specificity of 10.14%, whereas Lissamine Green showed a sensitivity of 60.01% and specificity of 7.24%.

**DISCUSSION**

The McMonnies score indicated a 24.13% prevalence of dry eye symptoms in the total population studied. 585 subjects having scores greater than 14.5 then underwent clinical dry eye tests. 572 were diagnosed as having dry eye by clinical tests. However 13 (2.72%) subjects having a positive McMonnies score did not show any positive dry eye test indicating the sensitivity of 97.7%. McMonnies questionnaire is among the earliest and most widely used screening instruments for dry eye syndromes (DESs) with sensitivity reportedly varying between 87% and 98% and specificity between 87% and 97%. The overall prevalence of dry eye was 23.59%, among the total population screened. In our study, McMonnies score proved to be a good screening tool 15.64% when correlated with dry eye tests. Women Health Study reported prevalence of 7.8% after screening 36995 subjects above 49 years by interview. The prevalence reported by Blue Mountain Study was 15.3%. The Beaver Dam Study and Shiphai Eye studies are other studies reporting prevalence of 14.5% and 33.7% respectively. In all these studies the diagnosis was based on symptoms and history alone and no confirmation by diagnostic clinical tests was done.

Albietz, Julie M. have reported prevalence of 10.1%. In their study, diagnosis was established by McMonnies Questionnaire followed by diagnostic clinical
An Indian hospital based population study conducted in the year 2005, has shown 18.4% prevalence of Dry Eye on the basis of clinical tests. Our results were comparable to the results obtained by them. The prevalence of Dry Eye was 14.54% in males and 24.03% in females below 40 years of age. A significant increase in prevalence with age was noted in both the sexes above 60 years including 20.97% of the males and 31.21% of the females. After applying Chi Square test for independence p value obtained was 0.01, which showed a significant association between the age and sex distribution. Other studies, have also reported a higher prevalence of Dry Eye in females. In our study, the prevalence of dry eye progressively increased with age. The difference was statistically significant. (p=<0.0001.) The hospital based population study done in India reported a 36.1% prevalence of Dry Eye in the age group above 70 years and 20% in the age group 31-40 years. The population based study in Indonesia reported increased prevalence of 37.6% in older population. Other studies also have shown similar results, where dry eye prevalence progressively increases with age. Tear Film Break Up Time was most frequently reported positive test (78.29%). A rapid tear film break up time is seen in both aqueous tear deficiency as well as Meibomian Gland Dysfunction. The lid abnormalities and Meibomian Gland Dysfunction in the form of moderately altered expressibility and secretion quality with inspissated or creamy fluid or severely altered expressibility and secretion with purulent fluid (toothpaste like) were recorded in 196 (33.50%) subjects. Rose Bengal staining was positive in 158 (27.00%) subjects. Lissamine green was seen in 77(9.74%) subjects. Rose Bengal dye and Lissamine green dye are used to study the epithelial cells that are not coated with mucin indicating mucin layer deficiency. Rose Bengal dye causes more irritation than Lissamine green dye. In our study, all the subjects having Lissamine green test positive had Rose Bengal stain positive implying Rose Bengal as a more sensitive test than Lissamine Green. Positive Schirmer’s test was noted only in 108 (15.55%) subjects indicating Aqueous Tear Deficiency. It is known to give variable results. In our study, tear film break up time showed better chances of diagnosing dry eye than any other tests, which was contradictory to the study by Rehman A and Yahya K, who showed the Schirmer’s test to be more reliable. A positive correlation between Mcmonies score and the dry eye test results was noted. The Lipid Layer Anomaly was most commonly seen in 60.85% of dry eye subjects followed by Meibomian Gland Dysfunction (33.50%). Mucin tear deficiency was recorded in only 27.00% subjects while Aqueous Tear Deficiency was recorded in 18.63% subjects. There was over lapping of the test results showing simultaneous involvement of multiple layers. Subtype based prevalence reported by Albietz, Julie M. was Lipid Anomaly Dry Eye (4.0%), Aqueous Tear Deficiency (1.7%) and there was no diagnosed case of primary mucin anomaly. The overall prevalence (10.8%) reported by them was also less
than that observed in our study. Further, they included the allergic or toxic dry eye and primary epitheliopathies and lid surfacing or blinking anomalies as two separate subtypes with prevalence of 3.1% and 1.8% respectively.9

Specificity and sensitivity of tests: Taking Schirmer’s test as gold standard, screening test analysis was done. Studies by Bjisterveld15 and Vitali16 both have shown a high sensitivity (85% and 83% respectively) of Schirmer’s test. In the same study, Vitali has shown TFBUT sensitivity and specificity to be 72% and 68% respectively. Mengehar17 has shown TFBUT to have a high sensitivity (83%) and high specificity (85%). In our study Rose Bengal test was the most sensitive whereas TFBUT showed a good sensitivity as well as specificity.

Limitations
Only those subjects having scores greater than 14.5 were further evaluated using dry eye tests. As a result subjects, who had score lesser than 14.5 but still could have dry eye were missed. The cases having severe ocular surface inflammations were excluded from the study which could have affected prevalence of dry eye.

In conclusion:
1. Overall prevalence of dry eye was 23.59% among the total population screened.
2. Lipid Anomaly Dry Eye was most prevalent (14.68%) followed by Meibomian Gland Dysfunction (8.08%), Mucin Layer Deficiency (6.51%) and Aqueous Tear Deficiency (4.49%).
3. McMonnies Questionnaire was found to be effective in screening dry eye when correlated with dry eye clinical tests.
4. Tear Film Break Up Time was found to have better sensitivity as well as specificity than other tests used for diagnosing dry eye.

REFERENCES