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Evaluation of Dry Eye Disease in Geriatric and Pre Geriatric Middle-Aged Subjects Attending a Tertiary Care Hospital in Puducherry

Lavnya Krishnamurthy[*,†,1,2], Thanikachalam. S[3], Geeta Behera[4], Ramesh. J[5], Radhika. V[6]

[1]*Department of Ophthalmology, Indira Gandhi Government General Hospital and Post-Graduate Institute, Puducherry.*
[2]*Current Affiliation: Aravind Eye Hospital, Puducherry-605007*
[3]*Department of Ophthalmology, Indira Gandhi Government General Hospital and Post-Graduate Institute, Puducherry*
[4]*Department of Ophthalmology, Indira Gandhi Government General Hospital and Post-Graduate Institute, Puducherry*
[5]*Department of General Medicine, Indira Gandhi Government General Hospital and Post-Graduate Institute, Puducherry*
[6]*Department of Pathology, Indira Gandhi Government General Hospital and Post-Graduate Institute, Puducherry*

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ABSTRACT

Purpose: To determine the prevalence and risk factors of dry eye disease in Geriatric (>65 years) and Pre-geriatric (40-65 years) populations and to compare the same between both the groups.
Setting: Indira Gandhi Government General Hospital and Post graduate Institute, Puducherry, India
Design: Prospective, cross-sectional, clinical study
Methods: All patients above 40 years attending the out-patient departments were given the Mc Monnie and Ho screening questionnaire for dry eye symptoms and risk factors. Those with a score of > 14.5 were further evaluated using Ocular Surface Disease Index (OSDI) severity subjective questionnaire, and objective clinical tests inclusive of Schirmer's test, Meibomian Gland Dysfunction (MGD) assessment, Tear Film Break Up Time (TBUT), Fluorescein staining and Impression cytology. The prevalence, risk factors, clinical signs and symptom-sign correlation were determined and compared between the two groups.
Results: Among the 1029 patients screened, the prevalence of dry eye was 9.9%, being significantly higher among the geriatric (15.4%) versus pre-geriatric group (7.7%), p<0.000, among women (12%) versus men (6.6%), p<0.000, among arthritic (22.8%) versus non-arthritic (9.6%), p=0.005, and among diabetic (30.4%) versus non-diabetic patients (3.4%), p<0.000. Geriatric patients had a greater prevalence of Grade 4 MGD (66%) versus pre- geriatric group (26.9%), p<0.000. TBUT scores were low (<10 seconds) in both groups and co-related with OSDI symptom severity scores (r=1).
Conclusions: Aging, female gender, arthritis and diabetes were found to be significant risk factors. The Mc-Monnie and Ho questionnaire is a valid screening tool only for evaporative dry eye and is complemented by OSDI for screening in a hospital based setting.

Key words: Dry eye–Geriatric–Pre-geriatric–Symptom-sign correlation

1 INTRODUCTION:

Dry eye is a multi-factorial disease of the tear film and ocular surface that results in symptoms of discomfort, visual disturbance and tear film instability with potential dam-

* Corresponding author.
† Email: lavnya.krishnamurthy@gmail.com

age to the ocular surface. Most studies show that the incidence of dry eye increases with age [1] [2–12]. Understanding why the elderly and middle-aged population is at a higher risk of developing dry eye disease can help us to minimize the burden of disease on the aged population. We proposed to identify dry eye disease in the geriatric age group (>65 years) and pre geriatric middle aged population(40 to 65 years) attending our tertiary care hospital in South India with symptoms suggestive of dry eye disease in order to estimate the prevalence and associated risk factors thereof. We also looked at the diagnostic efficacy of the Mc Monnie and Ho and OSDI (symptom severity) questionnaires.

2 MATERIALS AND METHODS:

The study was a prospective, cross-sectional, hospital based, comparative study. The study was conducted at the Geriatric and Ophthalmology outpatient departments for a period of one year, from December 2015-December 2016. Pre geriatric population (40-65 years of age) attending General OPD were included for dry eye disease evaluation and comparison. Institutional Scientific Committee and Ethics Committee approval was obtained prior to commencement, and the study adhered to the tenets of the Declaration of Helsinki. We included patients between 40-65 years of age attending General OPD and those above 65 years of age attending Geriatric OPD (Geriatric age group of $\geq$ 65 years was chosen as per WHO guidelines). Exclusion criteria was: (a) Patients who had undergone any extra or intra ocular surgery, (b) Patients with evidence of any active ocular surface infection or inflammation, (c) Patients on topical ocular medications and (d) Severely disabled subjects with poor co-operation.

Patient information and preliminary symptoms were recorded using a standardized McMonies and Ho questionnaire [13], a screening questionnaire for dry eye disease which comprises 14 questions, with responses for each question scored from 0 to 3, based on the symptoms of the patient. It also has questions to asses for the presence of risk factors such as drug intake, alcohol consumption, and arthritis. The total score of all questions was calculated and patients with a score of >14.5 suggestive of dry eye disease underwent a detailed evaluation for signs of dry eye, to enable the diagnosis of dry eye disease. Further subjective evaluation and scoring of patient symptoms was done using a standard Ocular Surface Disease Index (OSDI) questionnaire [14, 15] for assessment of severity of dry eye. Patients were scored on the OSDI rom 0-100, with higher scores representing greater disability: 0-12 normal, 13-22 mild DED, 23-32 moderate DED and $\geq$33 severe DED. The index demonstrates sensitivity and specificity in distinguishing between normal subjects and patients with dry eye disease. Index score of >23 was considered symptomatic. The patient then underwent slit lamp evaluation to look for mucus strands in the tear film, corneal filaments, lid margin evaluation for any Meibomian gland dysfunction such as pouting, plugging of orifices, toothpaste like or oily secretions, frothing at the lid margins, tarsal conjunctival evaluation for any papillae and tear meniscus height. Specific tests for dry eye that were done were: assessment of meibomian gland dysfunction, Schirmer's test, impression cytology, fluorescein staining of the cornea and tear film break up time

Meibomian gland dysfunction was graded based on the extent of plugging of the gland orifices as follows: Grade 1-Plugging $<1/3^{rd}$ of orifices, Grade 2-Plugging of $1/3^{rd}$ to $2/3^{rd}$ of orifices, Grade 3-Plugging of $>2/3^{rd}$ of orifices, Grade 4-Plugging of all orifices. Schirmer's test was done by inserting a Whatmann 41 filter paper strip of 35x5mm into the lower fornix, at the junction of the medial 2/3rds and lateral $1/3^{rd}$, of an un-anaesthetized eye. After 5 minutes the amount of wetting was noted and graded as follows: (1) Normal value ~ $\geq$15mm wetting of the paper at 5 minutes, (2) Mild dry eye – 9-14mm wetting of the paper at 5 minutes, (3) Moderate dry eye – 4-8mm wetting of the paper at 5 minutes and (4) Severe dry eye <4mm wetting of the paper at 5 minutes. For impression cytology, one drop of local anaesthetic was instilled into the eye and excessive tear fluid and medications were wiped off. A 10x10mm^2 (for better sample yield) cellulose acetate filter paper of 0.2 m pore size (Santorius Stedium Biotech, GmbH 37070, Gottingen Germany) was applied on the superior nasal side of the conjunctiva, slightly pressed for five seconds and slowly peeled off. The paper was immediately transferred to a fixative solution. Staining was done by Papanicolau modification of Gill's technique and reported and graded using Nelson's method [16]. Fluorescein staining was done to assess the ocular surface damage caused by dry eye and was graded as follows: Grade 0-No staining, Grade 1-Mild staining limited to less than $1/3^{rd}$ of the cornea, Grade 2-Moderate staining of less than half of the cornea and Grade 3-Severe staining involving more than half of the cornea. The Tear Film Break Up Time (TBUT) was done to measure the evaporative component of dry eye. A strip of fluorescein was wet at its tip with drop of a non-preserved tear substitute eye drop formulation. The tear film was stained by placing the strip on the bulbar conjunctiva and the ocular surface was viewed under cobalt blue filter on the slit lamp. The patient was asked to blink and the time interval between the blink and the appearance of the first randomly distributed dry spot was noted. TBUT of <10 seconds is indicative of tear film instability. Further correlation between signs and symptoms in both groups were analysed.

Statistical calculation method:

Data was analysed using SPSS Version 20.0. To test the significant difference between geriatric and pre geriatric groups Pearson's Chi square test was used, from which Chi square value and p value were obtained. Analysis of correlation between symptoms and signs was performed using Spearman Rho correlation calculator, R value (Rho constant for correlation) and p value were obtained from these tests. The tests were considered statistically significant when p value was <0.05.

3 RESULTS:

Our study population included 1029 subjects, out of which 324 patients belonged to the Geriatric (>65 years of age) category and 705 patients belonged to the Pre geriatric category (40-65 years of age) Table 1. Mean age was 71.92 ± 4.78 years for the geriatric and 50.71 ± 5.86 years for the pre geriatric group. Among the 1029 patients there were 409 males and 620 females. 102(9.9%) patients had a Mc Monnie and Ho score of ≥14.5. Hence the prevalence of Dry Eye Disease among our study population was found to be 9.9%. The prevalence of dry eye based on Mc Monnie score was found to be significantly greater in the geriatric than pre-geriatric group ~ $p < 0.001$ (Table 1). There was a significantly greater number of females than males with a Mc Monnie and Ho score of >14.5 (p ~ 0.003) (Table 1,Figure 1). A significantly greater number of geriatric than pre-geriatric patients complained of dryness in other organs like the mouth, throat and vagina ~ p <0.001 (Table 1). Among the 142 patients with arthritis 74 were geriatric (22.8%) and 68 were pre geriatric (9.6%) ~ p 0.005 (Table 1). The prevalence of dry eye among those with arthritis was statistically significant as compared to those without arthritis ~ p 0.005 (Table 1,Figure 2).

Among the patients with arthritis 38(51.3%) geriatric and 23(33.8%) pre-geriatric patients had positive Schirmer's test. The difference was found to be statistically significant ~ p 0.01. None of the other clinical tests showed any statistically significant difference between the two groups Figure 3.

Among the study population 21(6.4%) geriatric and 35(4.9%) pre geriatric patients gave history of Diabetes mellitus Table 1. The prevalence of dry eye among those with diabetes was statistically significant as compared to those without diabetes ~ $p < 0.001$ Figure 4.

Among the diabetic patients, significantly greater number of geriatric than pre-geriatric patients had a positive Schirmer's test (~ $p < 0.001$) and a TBUT of less than 10 seconds (p ~ 0.02). For all the other tests, the difference between the two groups was not statistically significant Table 2.

60(18.5%) geriatric and 74(10.4%) pre-geriatric patients had increased sensitivity to smoke. This difference between the two groups was found to be statistically significant ~ $p < 0.001$. Among those with a score of ≥14.5 (50 geriatric and 52 pre geriatric patients) a majority fell into the moderate to severe category based on symptom severity. The mean scores were 64.77±9.36 for the geriatric and 69.26±10.88 for the pre geriatric groups respectively (Table 3, Figure 5). A majority of the symptomatic patients had Grade-4 MGD, which was significantly more in the geriatric group ~ p value < 0.001 (Table 3). 50 geriatric(100%) and 52 pre geriatric(100%) patients with a Mc Monnie score of ≥ 14.5 had a Tear Film Break Up Time of less than 10 seconds in both eyes (Table 3). In both the geriatric and pre-geriatric groups TBUT severity co-related with the severity of OSDI scores (r=1, p=0.00) . None of the other dry eye tests co-related with OSDI scores.

4 DISCUSSION:

The criteria used to confirm a "dry eye diagnosis" differs widely between studies, resulting in great difficultly when attempting to compare results across studies. Due to the lack of a single diagnostic test or a combination of tests to effectively diagnose dry eye, many studies have reported a lack of correlation between symptoms and signs of the disease.

In this study, the prevalence of Dry Eye Disease based on Mc Monnie's score was found to be 9.9%. Previous studies have shown a prevalence ranging from 14.4% to 52.4% [2, 3, 5, 7–10]. Each of the population-based studies evaluated used a different definition of dry eye. Some studies included objective examination, but many did not. Nevertheless, in view of the poor performance (inconsistency, lack of repeatability, etc.) of commonly used clinical tests and the importance of symptoms as an indicator of both the clinical and public impact of dry eye, these data from large epidemiological studies have provided much needed information on the prevalence of dry eye.Our study was a hospital based study with a limited study period of one year. Hence only 1029 patients could be screened and therefore the lower prevalence as compared to previous studies. In this study the prevalence of dry eye disease was found to be 15.4% in the geriatric and 7.3% in the pre geriatric group. With ageing the lacrimal glands undergo apoptosis and tear production decreases. There occur abnormalities in lid positioning (laxity, floppy eyelid, retraction, and lagophthalmos), meibomian gland dysfunction [4], rosacea, decreased corneal sensation and decreased blink reflex, which contribute to increased tear film break up and tear film instability in the elderly. There are only few studies in literature comparing prevalence of dry eye in the geriatric and pre geriatric groups. These have shown the prevalence of dry eye to range from 3.9%-20% in those younger than 60 years and from 7.6%-36.1% in those above 60 years. [2, 9, 12]. In our study 27(6.6%) males and 75(12%) females had Dry eye disease based on Mc Monnie score. Lacrimal gland dysfunction is more common in women because of lack of androgens and in postmenopausal women due to oestrogen deficiency. Androgens also modulate the immune system and tropic functions of the lacrimal glands and the functioning of the meibomian glands [17]. Previous studies have also shown a significantly higher prevalence of dry eye in women of 16.7%-22.8%, compared to men with 11.4%-14.9% [2, 9, 10]. The prevalence of dry eye based on Mc Monnie score was significantly higher in those with arthritis (59.2%) as compared to those without arthritis (2%). This shows that arthritis is significantly associated with dry eye. The same has been validated in previous studies [1, 2, 8]. In our study population, the Schimer's values were significantly lower among geriatric patients (51.3%) than the pre-geriatric patients (33.8%). This indicates that the aqueous component of the tear film is affected in patients with arthritis. Intake of systemic drugs like anti-depressants, anti-histaminics, diuretics and beta blockers have significantly been linked to dry eye [5, 8–10]. In our study the number of patients on

Table 1. Demographics, risk factors and symptom analysis

Study group Parameter being compared	Geriatric patients	Pre-geriatric patients	p value
Age distribution	324 (31.5%)	705 (6S.5%)	
Mean age	71.92 ±4.78 years	50.71 ±5.86 years	
Mc Monnie score_> 14.5	50/324 (15.4%)	52/705 (7.3%)	0.000059
History of arthritis (n=142)	74/324 (22.8%)	68/705 (9.6%)	0.005
History of diabetes (n=55)	21/324 (6.4%)	35/705 (4.9%)	
History of dryness in other organs(n=133)	60 324 (18.5%)	73/705 (10.3%)	0.000311
History of increased sensitivity to smoke exposure(n=134)	60/324 (18.5%)	74/705(10.4%)	0.000383

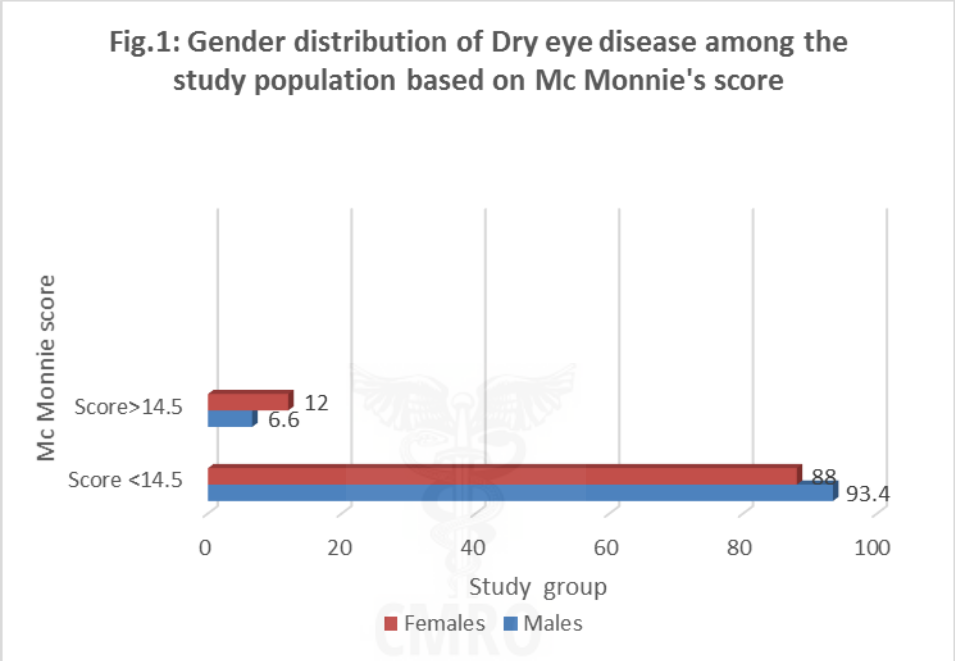

Figure 1. Genderdistribution of Dry eye disease among the study population based on Mc Monnie's score

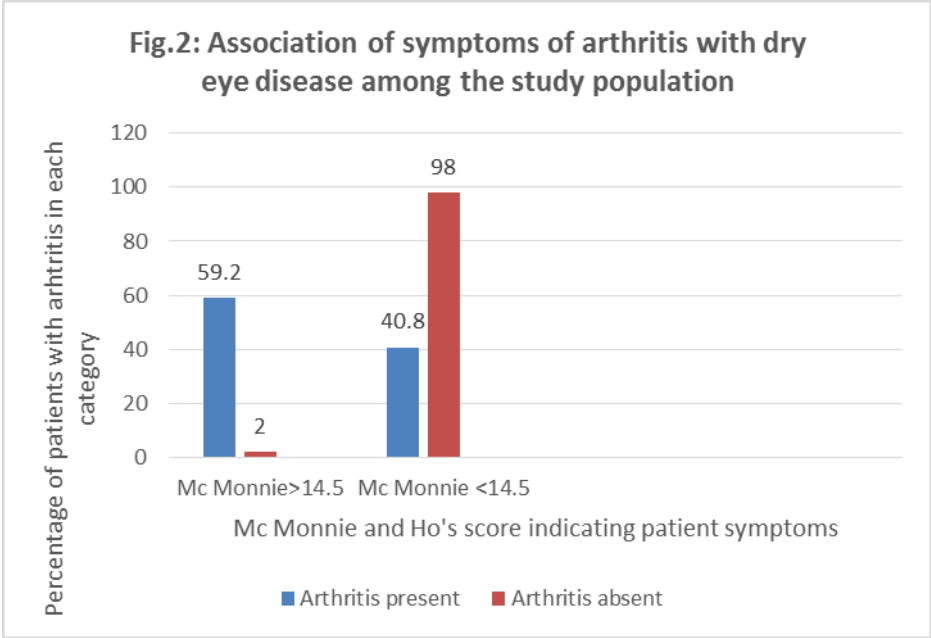

Figure 2. Associationof symptoms of arthritis with dry eye disease among the study population

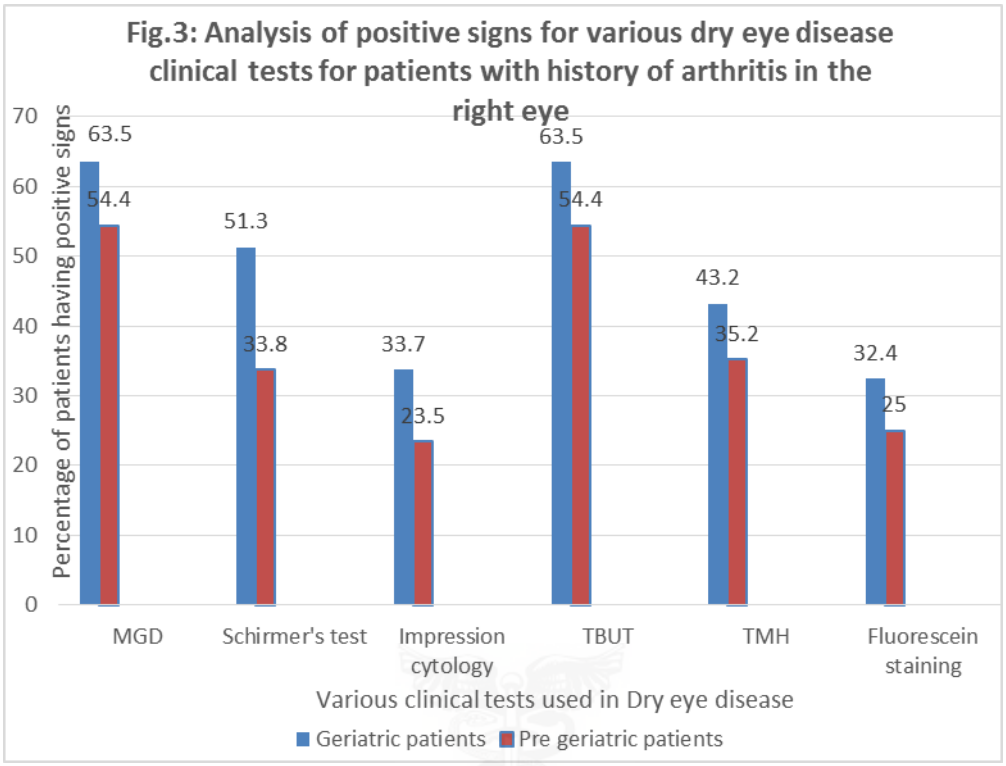

Figure 3. Analysis ofpositive signs for various dry eye disease clinical tests for patients withhistory of arthritis in the right eye

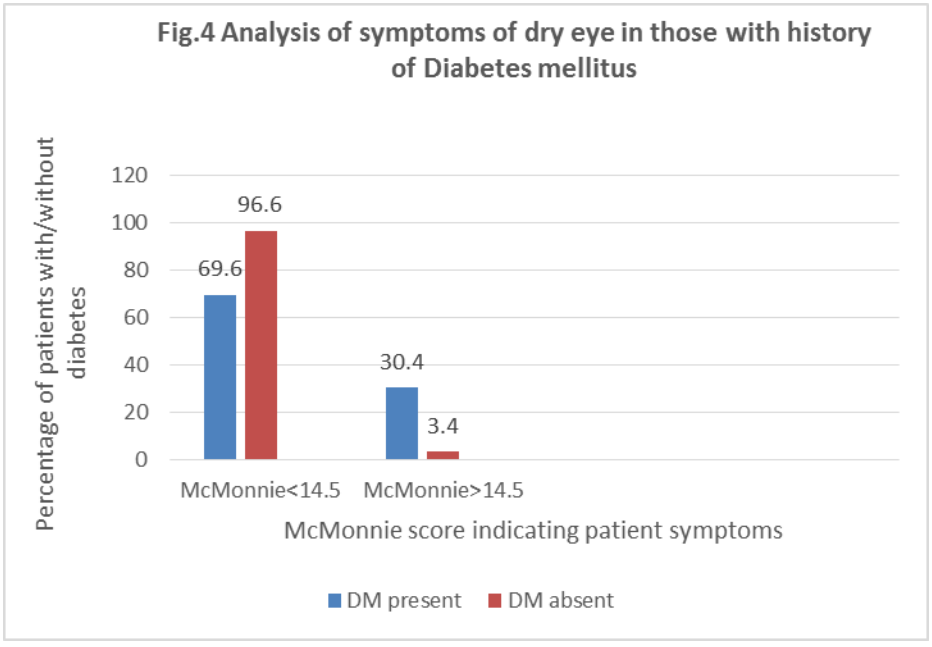

Figure 4. Analysis of symptoms of dry eye in those with historyof Diabetes mellitus

Table 2. Analysis of positive signs for various dry eye disease clinical tests for patients with history of diabetes

Study population	MGD	Schirmer's test	Signs being analyzed TBUT	Tear Meniscus Height	Fluorescein Staining	Impression Cytology
Geriatric patients (n=21)	16 (76.1%)	16 (76.1%)	17 (80.9%)	11 (52.3%)	9 (42.8%)	10 (47.6%)
Pre geriatric patients (n=35)	13 (54.2%)	9 (25.7%)	18 (51.4%)	10 (28.6%)	9 (25.7%)	9 (25.7%)
Chi square test		P < 0.00	P <0.05			

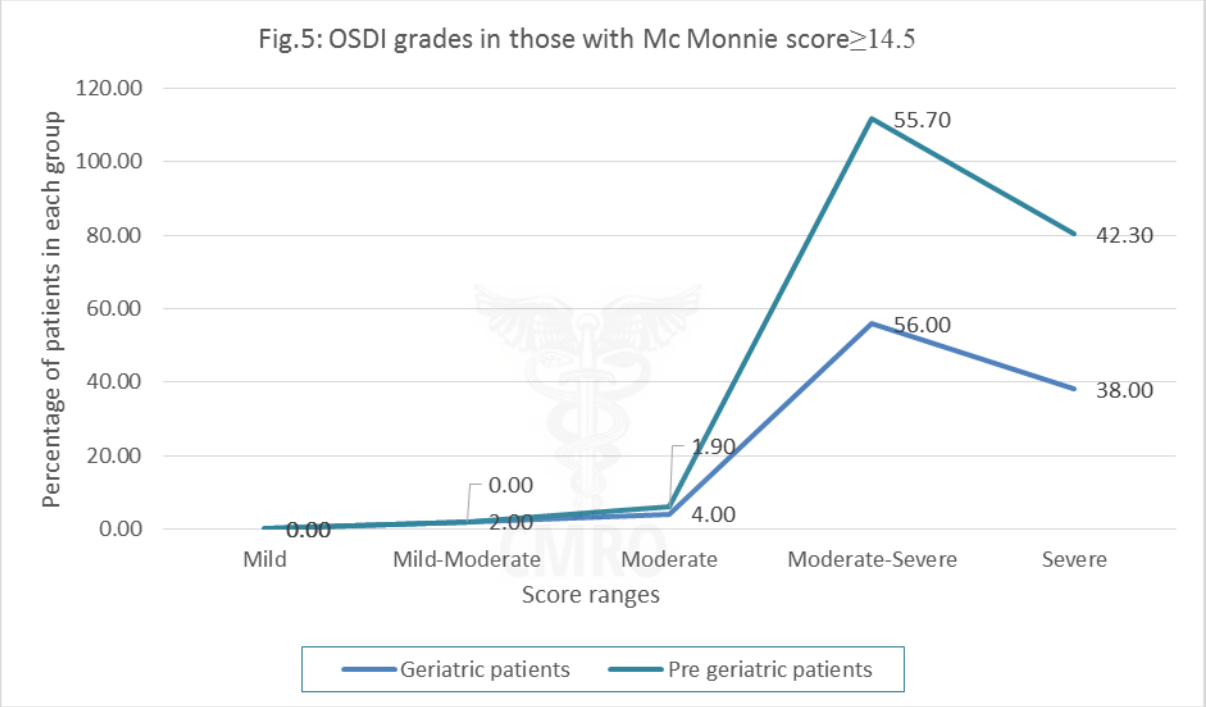

Figure 5. OSDI grades in those with Mc Monnie score≥14.5

Table 3. Analysis of OSDI scores and clinical signs of dry eye in patients with Mc Monnie and Ho score of > 14.5

Study group Parameter being analyzed	Geriatric patients (n=50) N=50	Pre-geriatric patients (n=52)	p value
Mean OSDI scores	64.77±9.36	69.2±0.88	
Patients having Grade-4 MGD in each group	33/50 (66%)	14/52 (26.9%)	0.000269
Patients having TBUT < 10 seconds in each group	50/50 (100%)	52/52 (100%)	NA

systemic drugs was too less to conduct a statistical analysis on the association between drug intake and dry eye. Diabetes mellitus has been identified as a risk factor for dry eye in several studies, including large population studies. It has been suggested that the association may be due to diabetic sensory or autonomic neuropathy resulting in decreased tear production, or to the occurrence of microvascular changes in the lacrimal gland [18]. In both cases the aqueous component of the tear film is mainly affected. Also due to decreased corneal sensations, there is decreased blink rate leading to increased evaporation [19].We found the prevalence of dry eye to be significantly greater among diabetics (30.4%) than non-diabetic patients (3.4%). Hence we found diabetes to be a significant risk factor for dry eye, in agreement with previous studies [2, 5]. We also found significantly lower Schirmer values and TBUT values in geriatric diabetic patients, compared to pre-geriatric, indicating an aqueous and evaporative component deficiency. This is also supported by previous studies [20, 21]. There is lot of evidence in literature to suggest that MGD increases with

age. Age-related and other systemic factors or processes may influence the structure and/or function of the meibomian gland [22]. Decrease in Androgen secretion with increasing age may also affect meibomian gland function. We found a greater severity of MGD in our geriatric population than the pre-geriatric group. There are not many studies comparing MGD in the geriatric and pre-geriatric groups, although there are studies that report an increase in the lid margin and meibomian gland abnormalities with age [22, 23].All the 102 (100%) patients had TBUT $<$ 10 seconds, which correlated well with the severity of OSDI scores. No other clinical test correlated with OSDI scores, indicating a lack of a strong association between the symptoms and signs of dry eye, except for tear film instability. Literature also reveals poor symptom-sign co-relation [24–29].

5 CONCLUSION:

From our study we concluded that the prevalence of dry eye is greater in the geriatric population as compared to the pre-geriatric population and among females than males. Among those with symptoms of dry eye, elderly were more likely to report symptoms of increased sensitivity to smoke exposure and also dryness in the mouth, throat, etc. Arthritis and diabetes were significantly associated with dry eye. Analysis of the dry eye clinical tests in both Arthritic and Diabetic patients, revealed an aqueous component deficiency in geriatric arthritic and diabetic patients and an additional evaporative component involvement in geriatric diabetic patients. Based on the OSDI symptom severity scoring, a majority of patients fell into the moderate and moderate-severe dry eye disease category. Dry eye clinical signs analysis in those with a Mc Monnie score of $\geq$ 14.5 revealed that there was a significantly greater severity of Meibomian gland dysfunction in the geriatric compared to the pre geriatric population. All patients in both groups had a TBUT of $<$ 10 seconds, also indicating evaporative dry eye disorder. Also, it was found that the Ocular Surface Disease Index scores correlated poorly with all the measured clinical tests except for Tear Film Break up Time, which showed positive correlation in both the groups. All the symptomatic patients with a Mc Monnie score of $>$ 14.5 had at least one clinical sign positive, in our study. The Ocular Surface Disease Index (OSDI) is valuable to assess the frequency of dry eye symptoms and also complements other clinical tests of dry eye disease in evaporative dry eye only, indicating an underlying aetiology of meibomian gland dysfunction more commonly. Hence in our study, the clinical tests under estimated dry eye in those patients who experienced moderate to severe dry eye based on symptom severity and so a firm conclusion could not be made on the relationship between signs and symptoms. The Mc Monnie and Ho questionnaire can be used as a simple, quick tool to screen for dry eye patients, and together, both Mc Monnie and OSDI questionnaires complement each other for better evaluation of dry eye disease in clinical trials. The heterogeneity of dry eye symptoms warrants for more specific questionnaires pertaining to dry eye.

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