

Dry Eye In Welders Of Puducherry: A Rising Occupational Hazard

Muthukrishnan Vallinayagam, Rathna Kumar, Baba Durairaj, Sasidharan Adiyapatham, Thamizharasu Ravi
Sri Lakshmi Narayana Institute Of Medical Sciences And Research Institute, Puducherry, India

Background:- Dry eye is an ocular surface disorder. It is an occupational hazard in welders and significantly affects the quality of life. Early diagnosis is imperative as it is potentially treatable. Awareness about regular ophthalmic evaluation and use of personal protective Equipments (PPE) would be beneficial in reducing ocular morbidity. Our aim was to estimate the prevalence of dry eye in welders of Puducherry.

Materials and Methods:- A cross-sectional study was conducted with 200 welders from Puducherry. They were examined for the presence of dry eye using Schirmer's test, and dry eye was graded based on the severity. Comparison of two proportions was employed and Chi-square test was used to detect the association between variables.

Abstract

Results:- The prevalence of dry eye in welders was observed to be 42.5%. While 32.94% of welders with bilateral dry eye showed similar grades of severity in both eyes, 27.06% displayed varying levels of severity. Dry eye was noted only in the right eye in 23.53% welders and only in the left eye in 16.47%. There was a significant correlation between the prevalence of dry eye and the duration (in years) of exposure to welding ($X^2=6.78$, $p=0.034$). Furthermore, the study demonstrates a significant association between dry eye and working hours (per day) in two different study groups (<9 hrs and ≥ 9 hrs) ($Z=6.3$, $P=0.0001$).

Conclusion:- Prevalence of dry eye in welders is considerably high. The impact of dry eye on the quality of life should not be underestimated. Dry eye in welders is an important occupational hazard which requires prompt treatment, to reduce the ocular morbidity and improve the quality of life. A recommendation from this study would be to educate the welders and create awareness and to prevent this occupational disease by implementing regular usage of personal protective equipments.

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Keywords: dry eye, welders, occupational hazard, Schirmer's test

Introduction

Dry eye disease is a common ocular surface disease affecting 5% to 30% of the global population, which significantly affects the quality of life.¹ Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance and tear film instability, with potential damage to the ocular surface. Dry eye in welders is an occupational environment related ocular surface disease. Dry eye in welders may manifest with either aqueous tear deficiency or evaporative tear deficiency.² Majority of the population is exposed to artificially controlled environment with a low humidity, that adversely affects the tear film physiology.³

Materials and Methods

This is a cross-sectional study, involving screening and observation. The main aim was to estimate the prevalence of dry eye in welders from Puducherry. Informed consent was taken from the welders and the study was approved by the institutional ethics committee. The duration of the study was 6 months (March 2015 to September 2016). Two hundred welders from Puducherry with a minimum of one year exposure to welding were selected. Workers with diabetes, those on therapy with antihypertensive drugs (diuretics, beta blockers), ocular surface disorders, allergic conjunctivitis, old age (>60 years), disorders of eyelids and those with a history of ocular surgery performed within six

months were excluded from the study. Schirmer's test was conducted in the vicinity of welding shops at normal room temperature. The diagnosis and grading of dry eye was performed using a standard 5×35 mm strip of Whatman-41 filter paper. The patients were categorised into 4 different grades based on the severity of dry eye syndrome. Tear Film Break up Time (TBUT) was performed in those diagnosed with dry eye, before initiating treatment. The severity of dry eye was solely based on Schirmer's test and TBUT was not used to grade the severity of dry eye.

Dry eye severity level:

Grade 1: Mild dry eye [MDE] : Schirmer's value 11 – 15 mm
Grade 2: Moderate dry eye [MODE] : Schirmer's value 6-10 mm
Grade 3: Severe dry eye [SDE] : Schirmer's value 3-5 mm
Grade 4: Very severe dry eye [VSDE] : Schirmer's value < 3 mm

Statistical analysis: Chi-square test was used to detect the association between the variables. Comparison of two proportions was used to detect the difference in prevalence of dry eye between two sets of working hours per day (<9 hrs and ≥ 9 hrs). Statistical analysis was done to decipher the association between the prevalence of dry eye and duration (in years) of exposure to welding.

Results

The prevalence of dry eye disease in welders was 42.5% (Figure 1).

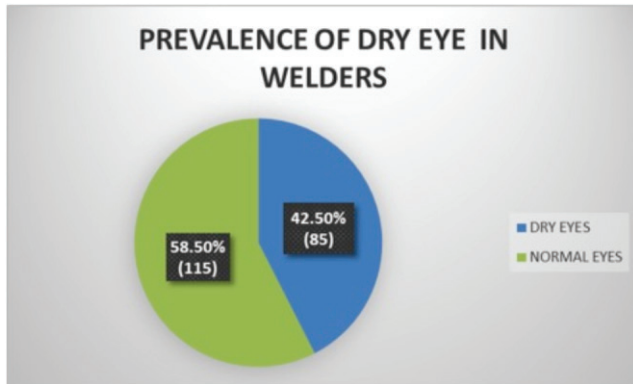


Figure 1: Prevalence of Dry eye in welders

Welders with bilateral dry eye with similar levels of severity in both eyes were 32.94%. Welders with moderate dry eye in both eyes made up the majority, followed by welders with severe dry eye, very severe dry eye and mild dry eye disease, in decreasing order of frequency (Table 1). Bilateral dry eye with different levels of severity in both eyes accounted for 27.06%. Welders with moderate dry eye in the left eye and varying grades of severity in the right eye constituted the majority, followed by other groups as shown in table 1. Unilateral dry eye affecting only the right eye accounted for 23.53%. Amongst them, welders with moderate dry eye formed the majority, followed by welders with mild, very severe and severe dry eye. Dry eye only in the left eye comprised of 16.47% and amongst them, welders with mild dry eye constituted the bulk, followed by moderate and severe dry eye (Table 1). With increasing age (in decades), the prevalence of dry eye increased proportionately, escalating from 16.66% (in age group 11-20 years) to 58.33% (above 50 years) (Figure 2).

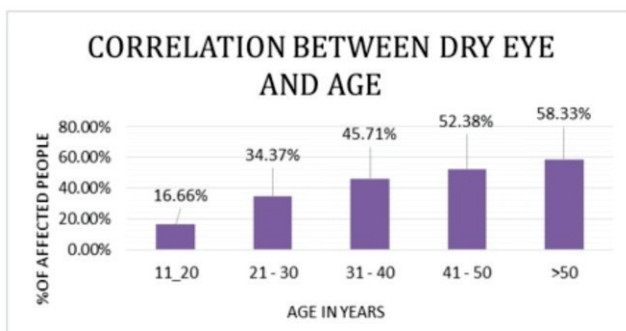


Figure 2: Correlation between Dry eye and Age

A significant correlation was noted between the prevalence of dry eye and duration (in years) of exposure to welding ($\chi^2=6.78$, $p=0.034$). The prevalence rate rapidly inclines from 36.60% (< 10 years of exposure) to 85.70% (>30 years of exposure) (Figure 3). A marginal difference was demonstrated between the prevalence of dry eye in two groups of working hours (per day). The prevalence was found to be 42.85% (< 9 hours) and 41.50% (≥ 9 hrs). According to the comparison of two proportions ($Z=6.3$, $P=0.0001$), there was a significant association between daily working hours and the prevalence of dry eye (Figure 4).

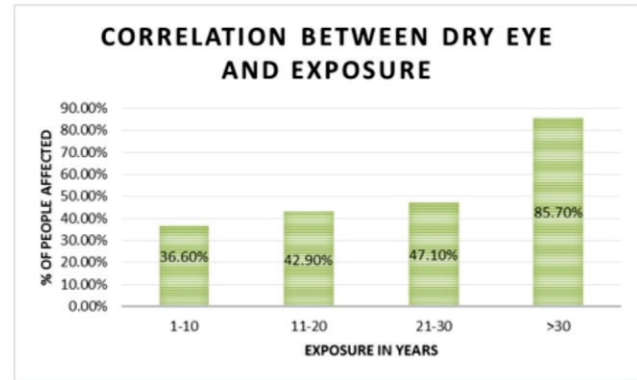


Figure 3: Correlation between Dry eye and Exposure

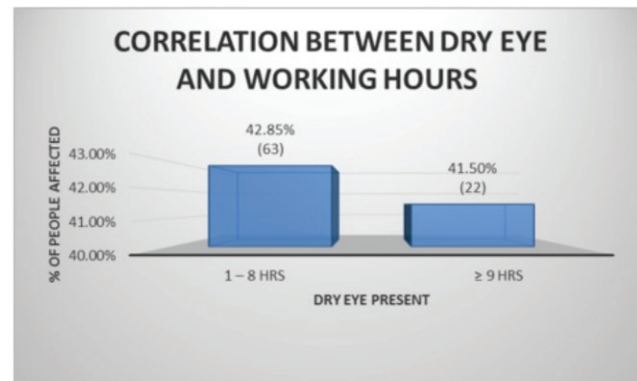


Figure 4: Correlation between Dry eye and Working hours

Dry eye had an adverse impact on daily activities like driving (62.35%), recreational activity like television (23.52%), reading (12.94%), mobile phone usage (2.35%) and sports (1.17%) (Figure 5).

Most of the welders with symptomatic dry eye complained of burning sensation, discomfort, photophobia and watering. Seven percent of welders underwent regular ophthalmic screening and 51.5% approved of regular usage of protective goggles at work.

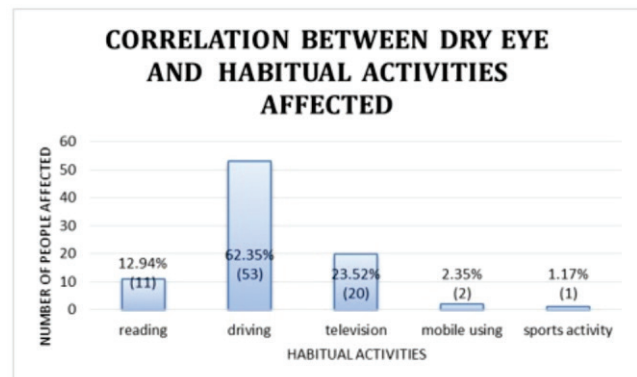


Figure 5: Correlation between Dry eye and Working hours

Discussion

Dry eye is a multifactorial disease of the tears and ocular surface, resulting in symptoms of discomfort, visual disturbance and tear film instability. It is accompanied by an

Table 1: Distribution of BCVA (Best Corrected Visual Acuity) During Each Follow Up

| Prevalence of Dry eye | No. of Cases | % |
|--|--------------|-------|
| Normal eyes | 115 | 57.5 |
| Dry eye present in both eye (same grade of severity) | | |
| MDE | 6 | 21.43 |
| MODE | 9 | 32.14 |
| SDE | 7 | 25 |
| VSDE | 6 | 21.43 |
| Dry eye severity levels | | |
| Both eyes with same grade | 28 | 32.94 |
| Both eyes with different grades | 23 | 27.06 |
| Present only in right eye | 20 | 23.53 |
| Present only in left eye | 14 | 16.47 |
| Dry eye present only in right eye (with severity levels) | | |
| MDE | 7 | 35 |
| MODE | 8 | 40 |
| SDE | 2 | 10 |
| VSDE | 3 | 15 |
| Dry eye present only in Left eye (with severity levels) | | |
| MDE | 8 | 57.14 |
| MODE | 4 | 28.57 |
| SDE | 2 | 14.29 |
| VSDE | 0 | 0 |
| Dry eye in Both eyes (varying grades of severity) | | |
| Right eye mild with | | |
| Left eye moderate | 4 | 17.39 |
| Left eye severe | 2 | 8.696 |
| Left eye very severe | 2 | 8.696 |
| Right eye moderate | | |
| Left eye mild | 3 | 13.04 |
| Left eye severe | 1 | 4.348 |
| Left eye very severe | 0 | 0 |
| Right eye severe | | |
| Left eye mild | 1 | 4.348 |
| Left eye moderate | 5 | 21.74 |
| Left eye very severe | 0 | 0 |
| Right eye very severe | | |
| Left eye mild | 1 | 4.348 |
| Left eye moderate | 1 | 4.348 |
| Left eye severe | 3 | 13.04 |

increase in the osmolarity of the tear film and inflammation of the ocular surface.² Dry eye is an occupational hazard in welders, who are constantly exposed to heat, fumes, spark and low humidity in the working environment.

In early stages, the eye can adapt and compensate for the tear hyperosmolarity and tear film instability. However, if untreated, it can cause permanent damage to the tear film.⁴ Dry eye adversely affects vision and thereby hinders daily activities such as reading, driving, sports and recreational activities.⁵ The common symptoms are foreign body sensation, blurred vision, redness, photophobia and burning sensation.⁶ Twenty five percent of patients attending general ophthalmology clinics present with symptoms of dry eye.⁷⁻⁹ Aqueous tear deficiency may be due to reflex hyposecretion while evaporative dry eye may be due to low humidity in the working environment. Reduced blink rate aggravates dry eye by exposing the ocular surface to the ambient atmosphere for a longer duration.^{2,10,11} An interplay of these factors could be postulated to explain the increased prevalence of dry eye in welders. The welders fail to use ocular protective equipments like goggles, thereby compounding the risk of ocular morbidity. Studies have demonstrated dry eye exacerbations in patients exposed to controlled environmental conditions.³ It is a disease of multifactorial nature of tear film dysfunction and a sizeable proportion of population has been observed with this disease.¹²⁻¹⁴ Dry eye affects the daily activities and the quality of life of workers.¹⁵ It is crucial to counsel the patients diagnosed with dry eye to initiate prompt treatment.¹⁶

The prevalence of dry eye in the population based surveys is known to range from 14.4% to 33%.¹⁷⁻¹⁹ In our study, 42.50% of welders were diagnosed with dry eye which is remarkably higher than the general population (Figure 1). This reflects the impact of the working environment on the status of the ocular surface. We found that 32.94% had bilateral dry eye with similar levels of severity in both eyes. Varying levels of severity in both eyes was found in 27.06% (Table 1).

In welders with unilateral dry eye, the right eye (23.53%) was found to be more affected than the left (16.47%). The welders habitually close one eye during welding and many of them believed that they close their left eye, which may provide a possible explanation for the predilection.

The prevalence of dry eye increases proportionately with increasing age (in decades) (Figure 2). A study on hospital based incidence of dry eye showed a similar escalation with age.¹⁸ The Beaver Dam Eye study also reported a similar scenario.^{8,15,16} An increase in the prevalence of dry eye after the fourth or fifth decade of life has been reported.²⁰ It is well established that age is an important factor influencing the occurrence of dry eye. Our study shows an exponential increase in the prevalence of dry eye as the duration of exposure (in decades) increases (Figure 3). It also reveals a significant association between the prevalence of dry eye and daily working hours (Figure 4).

A study on dry eye syndrome in tropical countries showed a higher prevalence in outdoor workers (17.77%).²¹ Welding is predominantly an outdoor occupation and the increased prevalence of dry eye may be attributed to sun exposure and

dry arid atmospheric conditions. It has been demonstrated that both dry eye patients and the control group experienced dry eye exacerbations, when exposed to desiccating stress.³ Similarly, welders are exposed to heat, fumes and dust, worsening the desiccating environmental conditions.

A study conducted in a hospital based population in Tripura medical college reported a lower prevalence of dry eye (3.10%) due to geographical conditions and high humidity.¹⁹ The higher prevalence in our study could possibly be explained by the low humidity and high temperature in our locality. Studies also suggest that relative humidity is inversely related to the prevalence of dry eye.⁸

In this study, burning sensation in the eyes was recorded in the majority, followed by vague discomfort, photophobia and watering. The study conducted in urban and rural population of West Bengal also stated burning sensation as the major complaint.¹⁷ Other studies have reported symptoms like foreign body sensation, burning, redness, itching, blurred vision and photophobia.²²

Our study unveils the detrimental effect of dry eye on the daily routine of welders. The exacerbation of dry eye symptoms had an adverse impact on driving, recreational activity like television, reading, mobile phone use and sports (Figure 5). Many studies support the fact that dry eye significantly impairs daily activities, especially reading, computer use and driving.²³⁻²⁵ Dry eye causes a marked decline in the quality of life.^{25,26}

Only 7 % of welders underwent regular ophthalmic evaluation, exposing the negligence of the majority in seeking medical care. Welders using prophylactic protective measures on a regular basis accounted for 51.5%. Mandatory use of prophylactic measures and regular ophthalmic screening should be insisted.⁸ Early diagnosis and treatment of dry eye would help in improving the quality of life.²⁷⁻²⁹

The welders with dry eye were treated with artificial tears and were instructed regarding periodic follow up.

This study had certain inherent limitations. Schirmer's test, which was done for the diagnosis of dry eye, lacks sensitivity. The presence of confounding factors in the welding environment, like arid atmospheric conditions and sun exposure might have contributed substantially as predisposing factors for the occurrence of dry eye. Tear film break up time (TBUT) requires adequate cooperation for accurate interpretation, and hence was not used to grade the severity of dry eye. These tests are not infallible and may produce spurious results.

Conclusion

Dry eye is an under-diagnosed disease in the population. The prevalence of dry eye in welders is found to be considerably high. The impact of dry eye on the quality of life should not be underestimated. Dry eye in welders is an important occupational hazard which requires prompt diagnosis and treatment, to reduce the ocular morbidity and improve the quality of life. The use of personal protective equipments should be held mandatory and regular ophthalmic evaluation should be insisted.

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Address for correspondence

Muthukrishnan Vallinayagam MS, DNB, FRCS, FICO

Assistant Professor,
Department of Ophthalmology,
Sri Lakshmi Narayana Institute of
Medical Sciences, Puducherry, India
Email id: muthu2308@yahoo.co.in



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