



Original Research Article

Do dry eye test results differ in AC and non-AC office rooms? A comparative study in healthy young adults

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ABSTRACT

Aim: To study the effect of air-conditioning of ophthalmic investigation rooms on dry eye test results in healthy young adults.**Methods:** 100 healthy individuals in the age group of 20-30 years underwent dry eye evaluation in a non-AC room and same tests were repeated by the same investigator after exposing the participants to AC room for one hour with a pre-set temperature of 20°C and humidity 60%.**Results:** Assessment of symptoms suggestive of dry eye syndrome was done using the validated 5-Item Dry Eye Questionnaire and dry eye symptoms were found to be present in one-third of the participants. The mean values with standard deviation along with the p value were calculated for blink rate, TBUT, Schirmer's test at the end of 1 minute and at the end of 5 minutes were calculated for both non AC room and AC room groups. Statistical analysis was done using the Wilcoxon test. The average blink rate in the AC room was found to be higher in the AC rooms (12.7 ± 2.86 per min) than in the non- AC rooms (10.12 ± 1.81 per min) with a statistically significant difference (Wilcoxon Signed Ranks Test and $p=0.000$). The average TBUT values in the AC rooms (18.84 ± 6.53 s) were significantly longer than in the non-AC rooms (13.63 ± 4.29) and the difference was statistically significant ($p=0.000$). The average Schirmer's test value at the end of 1 minute was found to be higher in non AC rooms (11.49 ± 3.48) when compared to AC rooms (9.90 ± 3.02) and the difference was statistically significant. The average Schirmer's test value at 5 minutes was also found to be higher in non-AC room (28.92 ± 4.81) when compared to the AC room (21.92 ± 4.41) and the difference was statistically significant (p value of 0.000).**Conclusion:** We found significant impact on the tear evaporative parameters in young healthy individuals with the air conditioning of the room.© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by/4.0/>)

1. Introduction

Urban lifestyle is known to impact health including that of the eyes. A major emerging trend in the ophthalmology clinics is the use of air-conditioner (AC). AC reduces humidity and temperature of the rooms to an extent greatly different from those existing in the outdoor spaces or non-office times. A study by Ozkurt (2006) indicated that radiologists had more evidence of dry eyes when compared to non-radiologists and found environmental

factors including AC rooms as a risk factor for the same.¹ A study by O'Brien (2004) indicated that reading or sitting close to AC is likely to exacerbate dry eye problems.² According to Lemp (1995), AC leads to faster evaporation of tears causing symptoms of dry eye, further compounded by prolonged screen time in offices.³

Sophisticated ophthalmic equipment and modern office trends necessitate the use of AC in eye OPDs. Tests for dry eyes may therefore be conducted in rooms where temperatures and humidity are regulated by AC. Hence, the present study is intended to understand whether AC has an impact on dry eye test results. The objectives of the study

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were to compare the clinical tests for dry eyes in AC and non-AC rooms in healthy young individuals.

2. Materials and Methods

The study was conducted after obtaining clearance from the Institutional Ethics Committee and was conducted in accordance with the tenets of the Declaration of Helsinki and Indian Council of Medical Research ethical guidelines for biomedical research on human participants. Participants were enrolled for the study after administering informed written consent. This study was a non-invasive clinical investigation for dry eye before and after an intervention in the form of exposure of the participants to AC room for a continuous one hour. The sample size was calculated to be 96 rounded off to 100 based on the formula $SS = Z^2 \times p(1-p) / d^2$ where $z = 95\%$ confidence interval, prevalence of dry eye in Indian population = 32% and $d = 10\%$ allowable error.⁴ Participants were enrolled by convenience sampling from among the healthy young patients attending the ophthalmic OPD for routine eye check up or for problems unrelated to dry eyes. Apparently healthy adults in the age group of 20-30 years with no ocular surface disorder were included. The right eye of all participants was evaluated. Conjunctivitis, eyelid/eyelash abnormalities, contact lens use and prolonged/current ocular medication or post-operative cases were exclusion criteria. Evaluation of the participants was done first in the non-AC room of the out-patient department (temperature and humidity noted) and later in the AC room of the out-patient department with the temperature set at 20°C and humidity set to 60% after the participant had spent 60 minutes continuously in the room. Dry eye evaluation was done including dry eye symptom assessment using the validated 5-Item Dry Eye Questionnaire (DEQ-5), blink rate (average of three counts), tear film break up time (TBUT) after staining the ocular surface with sodium fluorescein 2% sterile strips (average of 3 readings). Ocular surface was studied with sodium fluorescein 2% and Lissamine green with the nature and extent of staining marked diagrammatically. The grading of staining was done using the Oxford Scheme.⁵ Schirmer's test was done using sterile Whatman 41 paper and counted at the end of 1 and 5 minutes without and with topical anesthesia using sterile paracaine eye drops. The test results before and after the AC intervention were compared using Wilcoxon test.

3. Results

3.1. Demography

The study group consisted of 100 participants; 53 males and 47 females with a ratio of 1.12:1. Two-thirds belonged to the age group 20-24 years and one-third, 25-30 years and the age-wise distribution among males and females was matched.

3.2. Dry eye symptom scores

According to the baseline evaluation with the 5-Item Dry Eye Questionnaire (DEQ-5) most participants had no dry eye symptoms (Score 0 to 5, 68%), others had mild to moderate (score 6 to 11, 32%), symptoms and none had severe (Score >12) dry eye symptoms. The mean DEQ-5 score in our study was 7.25 ± 4.5 .

3.3. Comparison of blink rates in AC and non-AC rooms

The average blink rate in the AC room was found to be higher in the AC rooms (12.7 ± 2.86 per min) than in the non-AC rooms (10.12 ± 1.81 per min) and the difference was statistically significant (Wilcoxon Signed Ranks Test and $p = 0.000$).

3.4. Comparison of TBUT in AC and non-AC rooms

The average TBUT values in the AC rooms (18.84 ± 6.53 s) were significantly longer than in the non-AC rooms (13.63 ± 4.29) and the difference was statistically significant ($p = 0.000$).

3.5. Comparison of Schirmer's test results in AC and non-AC rooms

The average Schirmer's test value at the end of 1 minute was found to be higher in non-AC rooms (11.49 ± 3.48) when compared to AC rooms (9.90 ± 3.02) and the difference was statistically significant. The average Schirmer's test value at 5 minutes was also found to be higher in non-AC room (28.92 ± 4.81) when compared to the AC room (21.92 ± 4.41) and the difference was statistically significant (p value of 0.000).

3.6. Comparison of ocular surface staining in AC and non-AC room

Only one eye showed grade 1 conjunctival staining with fluorescein which remained identical in both AC and non-AC rooms. Most (99%) of the eyes showed no areas of ocular surface staining with fluorescein and Lissamine green. The result could not be compared statistically.

4. Discussion

Dry eye disease is a complex disorder with a wide spectrum of clinical manifestations and is affected by both intrinsic and extrinsic factors. Environmental factors like dust and moisture imbalances are known to cause dry eye complaints.⁶ Air conditioning decreases temperature and humidity. The working conditions and circumstances, including air-conditioned rooms directly impacts the evaporative status of the eyes.⁷ The proportion of population with dry eyes is almost 32%, which means, at least one in 3 persons will undergo dry eye tests.

This necessitates that dry eye test results be uninfluenced by environmental factors like the AC room and produce accurate results. Our study participants were exposed to a temperature of 20°C and humidity of 60% for 60 minutes.

In our study, we compared the results of dry eye tests in the AC and non-AC rooms among healthy young adults of both genders during their third decade of life. Most of the participants (68%) had no dry eye symptoms as per the validated 5-Item Dry Eye Questionnaire (DEQ-5), only one third (32%) had mild to moderate dry eye symptoms and none had severe dry eye symptoms. The mean DEQ-5 score of 7.25 ± 4.5 . The proportion of individuals with dry eyes is similar to another study in which 30% of hospital patients were reported to have dry eyes when assessed with the same scoring system.⁸ This indicates that our study population was comparable to the normal population.

The average blink rate in the AC room was significantly higher in the AC rooms (12.7 ± 2.86 per min) than in the non-AC rooms (10.12 ± 1.81 per min). The effect of AC on the blink rate may be attributed to the decreased humidity in the room as shown by the study by Pfluger et al (2013).⁹ In a study on computer vision syndrome, blink rate was found to be 11.6 per min after a 15 minute reading task.¹⁰ In this study, apart from the visual task, the AC rooms may also have been a contributing factor. Acosta et al. reported a blinking rate of 12.4 ± 1.2 blinks per min in normal individuals that decreased to 10.3 ± 1.1 during visual tasks, whereas our study shows a significant increase in blink rate after one hour of AC room exposure.¹¹ This may be explained by the study conditions of Acosta wherein AC was maintained and subjects indulged in active visual tasks which might reduce the blinking rate. In our study, the participants were largely idle and were not carrying out any active visual tasks. Hence blink rate may not have been diminished in our study.

Tear film break up time (TBUT) in our study was found to be longer in non AC room than AC room, this finding was similar to a study conducted on radiologists working in AC and non radiologist.¹ Air-conditioned environments cause tear evaporation leading to a faster tear-film break up. This in turn can lead to dry eyes. Schirmer's test in our study was calculated at the end of 1 minute and 5 minutes, both the average values were more for non AC room than AC room. This was again found to be similar to the study done on radiologists and non radiologists.¹ Studies have shown that higher humidity and wind speed is inversely associated with the risk of dry eye.¹² Hence patients with an unstable or inadequate tear film report more symptoms of ocular irritation, but that resultant damage to the more sensitive cornea is more likely to produce symptoms.¹³ As all tests evaluate different characteristics of the tear film, it is unlikely that a single test can be a complete measure of dry eye, however it was seen that AC room exposure for one hour was found to affect not just one, but different dry eye tests.

5. Conclusion

In summary, most of the dry eye tests were found to be significantly altered after exposure to AC rooms compared the results in the non-AC rooms among young healthy individuals. The blink rate was higher, TBUT was shorter and Schirmer's test was decreased after AC room exposure when compared to non-AC rooms. The ophthalmologists should therefore keep this in mind that the dry eye tests may be affected by the AC room exposures. Necessary precautions should be taken by the ophthalmologist to ensure that the patients are seated in non-AC rooms before taking up for dry eye tests. Since AC rooms are more often being used by the offices the impact of such factors on the tear film need to be studied in the wake of increasing prevalence of dry eye disorders. Further studies are required to know how the AC rooms might impact the results of the dry eye tests among patients with dry eye of varying severities.

6. Source of funding

None.

7. Conflict of interest

None.

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