Correspondence of tear film osmolality and dry eye symptoms in a clinical setting

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Abstract

PURPOSE: Hypertonicity of the tear film as measured by tear osmolality has been described as superior in predictive value to any other single objective test for dry eye diagnosis. The relationship between tear osmolality and self-reported dryness symptoms was studied in a clinical setting.

METHODS: 25 sequential patients with an entering complaint of dry eye symptoms were evaluated. The Ocular Surface Disease Index (OSDI) and Self Evaluated Symptom of Dryness (SESoD) questionnaires were administered. Tear osmolality was measured with an Advanced Instruments Model 3100 Tear Osmometer accurate to 5 mOsm/kg H2O (1 SD). The tear sample was taken from the inferior fornix.

RESULTS: In this patient group, those with OSDI scores less than 25 (n = 14, normal to mild symptoms), had tear film osmolality of 304.5 ± 18 mOsm/kg H2O (SD 16.46). For those with OSDI scores of 25 or more (n = 11, moderate to severe symptoms), the osmolality was 329.7 ± 16 mOsm/kg H2O (SD 19.76). For those with SESoD score of 0 and 1 (n = 13, normals/controls), tear film osmolality was 304.8 ± 15 mOsm/kg H2O (SD 16.18), while patients with SESoD scores of 2, 3, or 4 (n = 12, mild to severe) had osmolality of 326.25 ± 20 mOsm/kg H2O (SD 19.76). These 2 groups were also significantly different (t-test, p = 0.006).

CONCLUSIONS: This study demonstrates that tear film osmolality can be measured in a routine clinical setting. The data confirm that dry eye patients with more severe symptoms exhibit higher tear osmolality readings, and also that both the single symptom of dryness (SESoD) and the more complete survey of symptoms and functions affected by ocular surface disease (OSDI) correlate with subjective measurement of tear film hypertonicity.

Introduction and Methods

Background

The concept of osmolality originated in 1748 by Nollett, a French priest and scientist. In 1882, Raoult showed the freezing point of water depends on osmolality. He found higher concentrations of solute lowers the freezing point. (1)

Various studies have been performed to measure the average tonicity of the dry eye. Tomlinson looked at the published data on tear osmolality and pooled the mean and standard deviations of normals and dry eye subjects. The meta-analysis yielded an osmolarity referent of 316 mOsmol/L, with 89% overall predictive accuracy for dry eye diagnosis. (2)

Methodology

22 subjects were measured for tear osmolality and dry eye symptoms in a clinical setting. The patients were given 2 questionnaires to categorize their level of discomfort due to ocular dryness. The Ocular Surface Disease Index (OSDI)© is a 12-item questionnaire on the severity of dry eye symptoms, effects on visual function, and environmental sensitivity related to ocular surface disease. It has been formally validated and used extensively in clinical research on dry eye.

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Figure 1: Collection of tear sample with flexible micropipette

Subjective Evaluation of Symptom of Dryness (SESoD) (3,4)

Over the past week, how often do you have dryness?

(0) Never
(1) Seldom
(2) Sometimes
(3) Frequently
(4) Always

Figure 2: Screen shot after sample is placed into Tear Osmometer

Subjective Evaluation of Symptom of Dryness (SESoD)

Osmolality of subjects with OSDI scores < 25 was significantly lower than that of subjects with higher scores (t-test, p<0.001). 

Over the past week, how often do you have dryness?

(0) Never
(1) Seldom
(2) Sometimes
(3) Frequently
(4) Always

Figure 3: Sample is frozen

Subjective Evaluation of Symptom of Dryness (OSDI)©

The Ocular Surface Disease Index (OSDI) is a 12-item questionnaire on the symptoms, effects on visual function, and environmental sensitivity related to ocular surface disease. It has been formally validated and used extensively in clinical research on dry eye.

Figure 4: Screen shot of sample melting as it is heated.

Discussion and Conclusion

• This study demonstrates that tear film osmolality can be measured in a routine clinical setting.
• The data confirm that dry eye patients with more severe symptoms exhibit higher tear osmolality readings.
• Both the single symptom of dryness (SESoD) and the more complete survey of symptoms and functions (OSDI)© correlate with objective measurement of tear film hypertonicity.

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