ARVO Annual Meeting Abstract | June 2020

Biophysical characteristics of tears in children

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Investigative Ophthalmology & Visual Science June 2020, Vol.61, 1389. doi:

Abstract

Purpose : The tear film forms an important part of our visual system and is essential for the functioning of the ocular surface. A stable tear film is required for preventing the most common ocular surface disease - dry-eye. Most of the studies on tears are conducted using samples from adult subjects and only few reports are available on tears of infants and children while it is known that infants and children have more stable tear film than adults. It is likely that nature of tears is different in children because dry-eye mainly occurs in adults. This study aimed at characterizing the biophysical characteristics of the tear film of children to look into tear film stability.

Methods : Tears were collected by the capillary tube method from lower lid tear meniscus of children ≤5years. Biophysical characteristics of tears were investigated using a Langmuir trough. The tear sample was spread on an artificial tear solution at 35°C. The tear film at the air-liquid interface was compressed and expanded to record pressure-area isocycles which provided information on the biophysical properties and stability of the tear film. Compressibility and elasticity of the film was determined from the pressure-area profiles.

Results : The tear film was highly compressible at the air-tear interface with small increments in pressure at large areas followed by continuous increase in pressure attaining a maximum surface pressure of 35mN/m at the highest compression. The tear film decreased the surface tension at the interface from 72mN/m to 38mN/m. Hysteresis was observed and the film occupied about 1000mm^2 lower area on expansion compared with compression between pressures 10 and 20mN/m but isocylces were reversible

indicating reorganisation of molecules. The in-plane elasticity of the film increased with compression showing highest value at the pressure 10mN/m followed by a phase transition.

Conclusions : Tears in children form compressible, reversible, and stable film which shows phase transition. The surface pressure of the tear film is higher than those normally observed with meibomian lipids indicating other components such as proteins might contribute to the stability of the film. Future studies will involve separating various components of children tears and investigating their contribution to overall stability of the film to identify components responsible for higher tear stability.

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