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Biophysical characteristics of the tear film in school-aged children

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Footnotes

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Abstract

Purpose : The ocular surface and tear film in children are not as well characterised as in adults. Biophysical properties of tears are associated with their ability to spread on the ocular surface and reduce surface tension to form a stable tear film. The aim of this study was to investigate biophysical properties of tears in school-aged children and examine the relationship with age.

Methods : Unstimulated tears were collected from 21 healthy children (age 6-14 years, 71% female) using glass capillary tubes. For each participant, tears were spread on the surface of an artificial tear solution reflecting the salt composition of tears and maintained at the physiological pH (7.4) and temperature (35°C) in a Langmuir trough. The tear film was compressed and expanded with two barriers and surface pressure was continually recorded with a pressure sensor to give pressure-area profiles. Pressure-area profiles were qualitatively compared between all participant tear

samples. Maximum surface pressure at the highest compression for each participant sample was determined from profiles. Associations between maximum surface pressure and age were examined using Pearson correlation, and male and female samples were compared using Mann-Whitney U test. Profiles were also compared with a representative historical adult tear sample (35 y, female, normal ocular surface).

Results : Pressure-area profiles of tear films of all participants indicated features of a stable, highly compressible liquid film with continuous increase in pressure without any collapse of the film. Profiles of child participants were similar and comparable to the profile of the historical adult sample. Group mean maximum surface pressure at the highest compression for child participants was 33 ± 3.5 mN/m. There were no significant relationships between maximum surface pressure and age ($p=0.8$) or sex ($p=0.7$).

Conclusions : Biophysical characteristics of tears in school-aged children are comparable with adult tears and are not affected by age or sex. Many components including lipids and proteins contribute to the surface pressure of tears. Surface pressure of adult tears is known to be higher than surface pressure of lipid component alone because of additional contribution from proteins. Future investigations will examine the contribution of different components in children's tears to overall tear stability.

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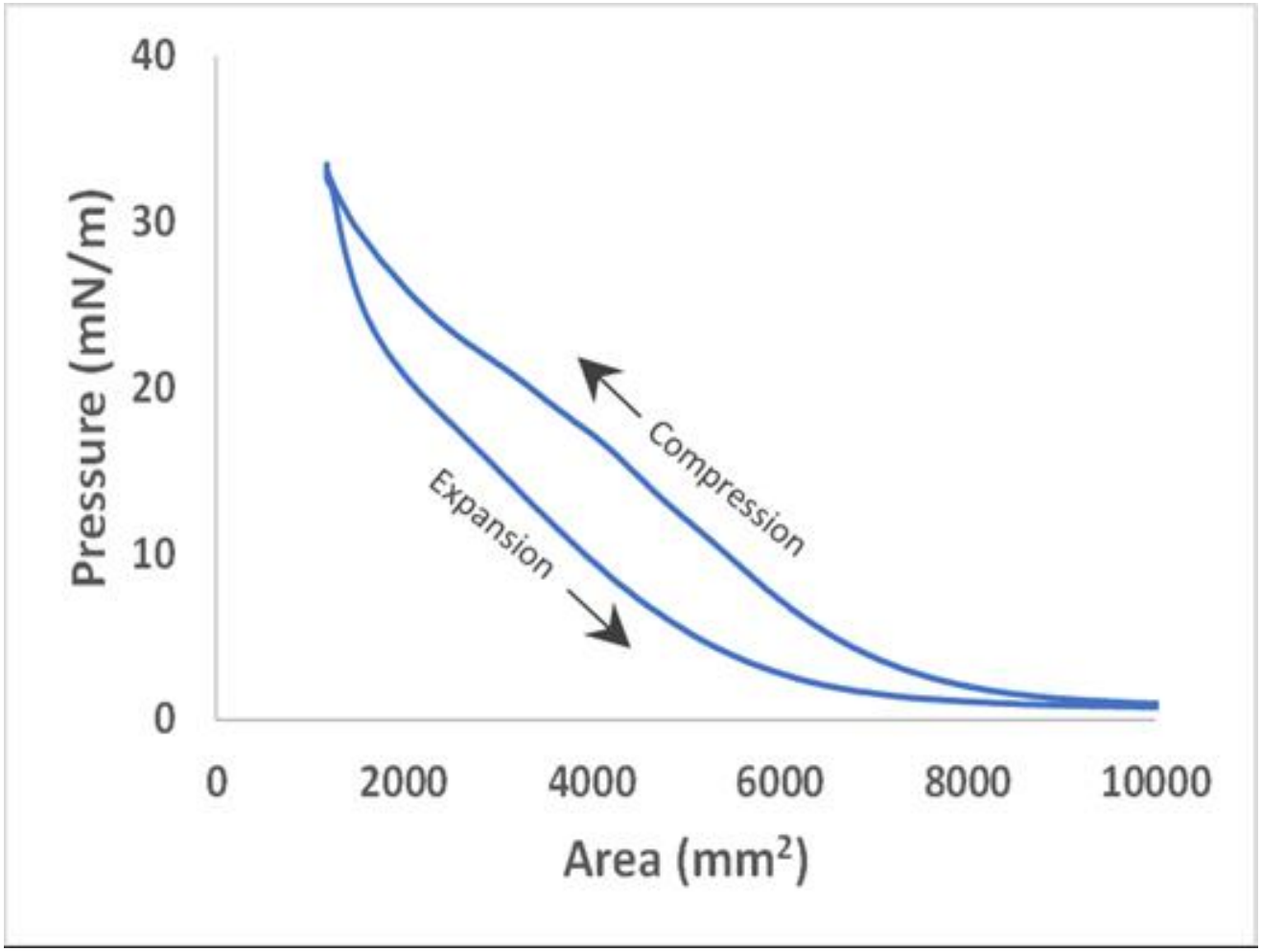

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A representative pressure-area profile of the tear film in children (12 y, male)