Experimental study to assess the influence of air draught on the lower tear meniscus height

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Introduction:

Some studies examine tear meniscus height under different testing conditions, for example normal conditions, wind stimulation and delayed blinking sessions [1,2]. In practice, the examiner has to take care of these factors to avoid mistakes during the assessment of tear meniscus height. An increase in the lower tear meniscus height is expected under wind stimulation.

Purpose:

The measurement of the tear meniscus height (TMH) is one of the standard tests to assess the quantity of the tear film. The aim of this study was to determine the influence of wind or air draught on TMH.

Methods:

A prospective, randomised study (n=40; 53% female, 47% male; aged (25.2 +/- 1.8)years) was conducted to measure central, nasal and temporal lower TMH in both eyes by means of a video-topographer with infrared illumination (*OCULUS* Optikgeräte GmbH, Keratograph 5M, TF-Scan Software, Version 2.2.18). After determination of the vertical pupillary centre is drawn a horizontal line to lower eyelid by using the measurement scale.

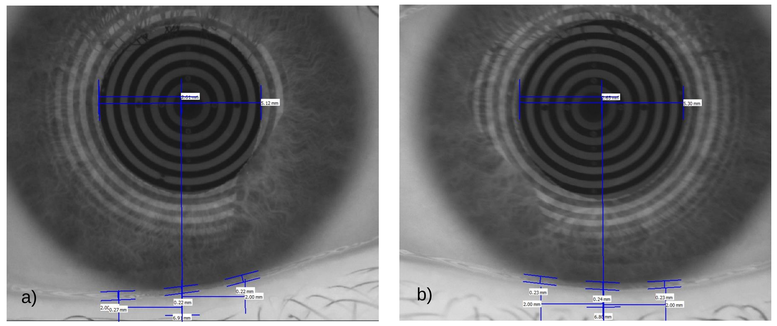

Fig. 1: Determination of the vertical pupillary centre and locations (central, nasal, temporal) of the TMH at the lower eyelid were executed with an integrated measurement scale (blue lines) of the video-topgrapher by the examiner. a) oculus dexter; b) oculus sinister

The TMH was determined at three locations. Both the nasal und temporal TMH were quantified two millimetres off the vertical pupillary centre. (Fig. 1). Three consecutive measurements of TMH were performed under normal conditions (NC-TMH) and with wind stimulation (W-TMH). The results of the measurement of TMH and pupil diameter are displayed closely beside each determination.

The air draught was generated by a wind tunnel (*Sziols* Inc.). Patients were exposed to air draught for one minute. At a distance of three metres between patient and wind tunnel the wind velocity was (0.8 +/- 0.2)m/s (Fig. 2). During the execution of the experiment, patients had to fixate on the aperture of the wind tunnel (Fig. 3). This means that air was blown frontally into the eyes. A wind velocity of (0.8 +/- 0.2)m/s correlates with *Beaufort* number 1 of the wind force scale. It characterises light air [3]. After that, the examiner determined W-TMH by the video-topographer .

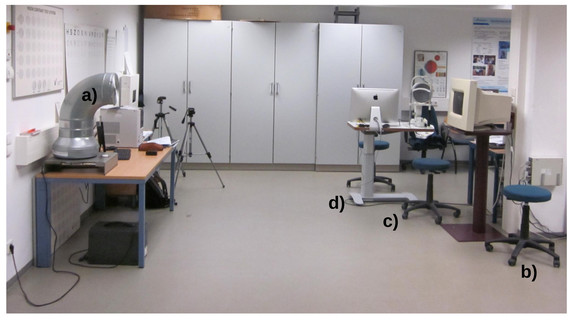

Fig. 2: The arrangement of the test devices of the study. a) profile of wind tunnel; b) examination chair (wind stimulation); c) examination chair (measurement of the TMH); d) video-topographer to measure the TMH

Fig. 3: Front view of the wind tunnel

Results:

Each location (central, nasal, temporal) of the TMH was compared under normal conditions and wind stimulation. The results for 80 healthy eyes are shown at the following chart (Tab.).

Tab.: Results of 95% confidence interval of the mean for the comparison of NC-TMH and W-TMH and *Wilcoxon signed-rank* test for the statistical analysis of significantly differences ($p < 0.05$) between NC-TMH and W-TMH n=40 (80 healthy eyes were examined)

Location	NC-TMH [mm]	W-TMH [mm]	95% confidence interval of the mean [mm]	Significance p (Wilcoxon test)	n
Central	0.29 +/- 0.13	0.36 +/- 0.17	(-0.10 to -0.05)mm	0.000	40
Nasal	0.27 +/- 0.12	0.35 +/- 0.18	(-0.10 to -0.06mm	0.000	40
Temporal	0.30 +/- 0.13	0.39 +/- 0.20	(-0.12 to -0.07)mm	0.000	40

A comparison of the TMH under normal conditions and wind stimulation is executed in Fig. 4 for each location

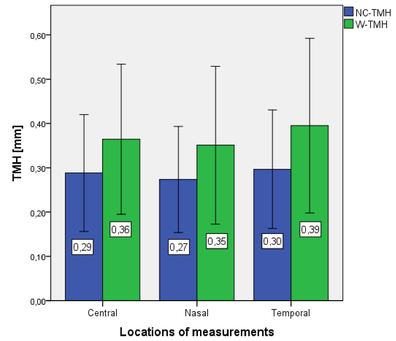

Fig. 4: Bar charts of averages (bar) and standard deviations (error bar, +/- 1 SD) of the measurements to compare TMH under normal conditions and wind stimulation; n=40 (80 healthy eyes were examined)

Tab. shows the results of the statistical analysis, executed by the *Wilcoxon signed-rank* test ($p < 0.05$). The selection of the test was caused by paired samples which are not normally distributed. There are statically significant differences between the NC-TMH and the W-TMH. All locations (central, nasal, temporal) of the W-TMH are significantly higher than the NC-TMH (95% confidence interval of the mean).

Conclusion:

The quantity of the tear film is affected by wind stimulation because of the differences between NC-TMH and W-TMH. Based on that, it is obvious that mistakes during the assessment of the TMH may occur if the patient has been exposed to air draught before. Hence, to avoid or minimise this influence, it is necessary to ask if the patient was exposed to conditions before tear film assessment.

References:

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