Study determining the reproducibility of the non-invasive break- up time by corneal topographer (NIK-BUT) method for infrared, red and white illumination

Julia Wittekind B.Sc.[1], Wolfgang Sickenberger M.S.Optom.(USA) Prof. Dipl.-Ing.(FH) [12] , Sebastian Marx Dipl.-Ing.(FH) [2]

1 Ernst-Abbe-Fachhochschule Jena, Germany, 2 JENVIS Research Institute, Jena, Germany

Introduction:

Dry eye is one of the most common diseases in the world [1]. Every fifth person suffers from this disease [2].

Today measuring of tear film stability, is focused on non-invasive methods [3]. To determine the influence of the examiner, an objective analysis should be used. One of these novel non-invasive methods is the non-invasive keratograph break-up time (NIK-BUT). The NIK-BUT is known as the tear film break- up time measured by means of the video topographer.

Purpose:

The aim of this study was to measure the reproducibility of the non- invasive keratograph break-up time (NIK-BUT) using three different illuminations: infrared, red and white.

Methods:

Forty-eight subjects were enrolled (mean age (34.8 ± 15.2) years; 50% female, 50% male). The reproducibility of NIK-BUT (OCULUS Keratograph 4, Version: 1.76b53rH) was tested on three consecutive days at the same day time. Infrared, red and white illumination was examined in a randomised order. A comparison of the first break-up (NIKf-BUT) and the average of all affected areas (NIKav-BUT) was made. Because of incorrect detection by the video topographer due to eyelashes, pupil light reaction and iris crypts, the values of the NIK-BUT have been adjusted (Figure 1).

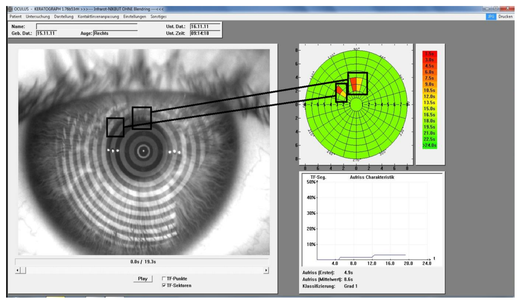

Figure 1: incorrect detection due to eyelashes

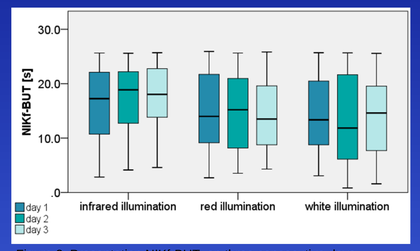

Figure 2: Presentation NIKf-BUT on three consecutive days

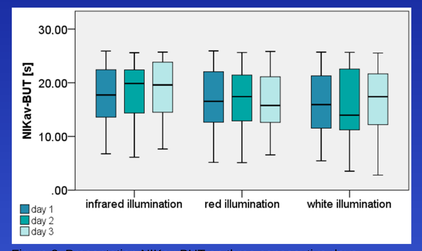

Figure 3: Presentation NIKav-BUT on three consecutive days

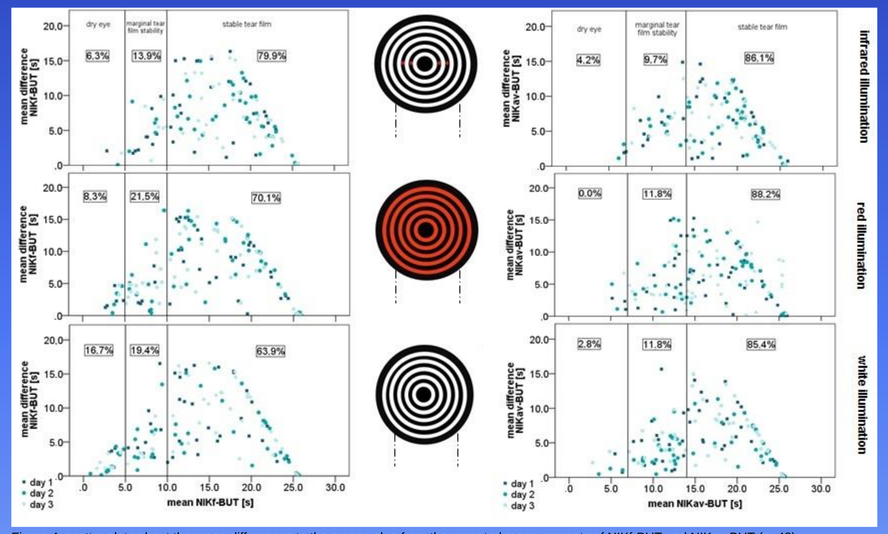

Figure 4: scatter plots about the mean differences to the mean value from the repeated measurements of NIKf-BUT und NIKav-BUT (n=48)

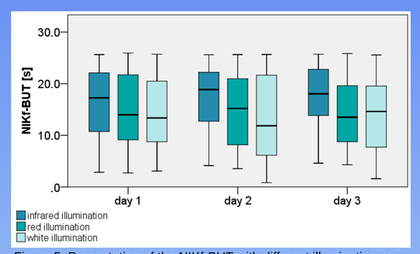

Figure 5: Presentation of the NIKf-BUT with different illumination on three consecutive days

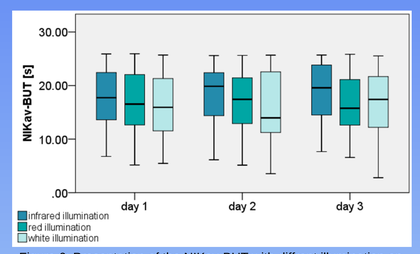

Figure 6: Presentation of the NIKav-BUT with diffrent illumination on three consecutive days

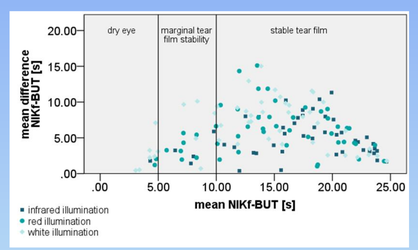

Figure 7: Scatter plot of differences about mean values from repeated measurements NIKf-BUT

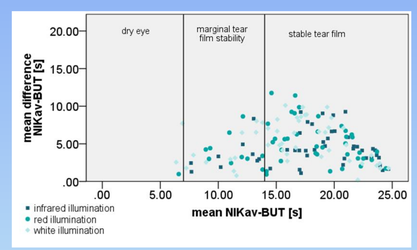

Figure 8: Scatter plot of differences about mean values from repeated measurements NIKav-BUT

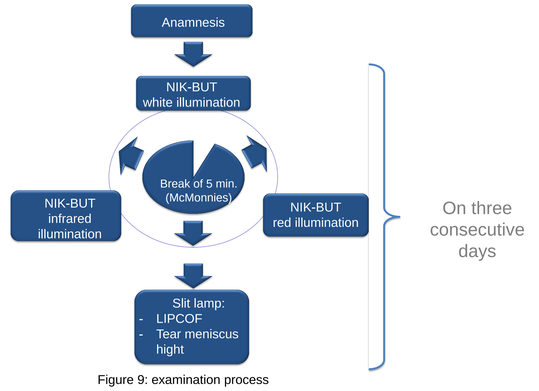

Figure 9: examination process

Results:

Only the values of the NIKav-BUT with red illumination were normally distributed (n= 48, *Shapiro-Wilk* p=0,094). The results show that there is no statistical difference regardless of the illumination, which was used on three consecutive days (infrared illumination: NIKf-BUT, *Friedman*-Test p=0.090, NIKav-BUT, *Friedman*-Test p=0.243; white illumination: NIKf-BUT, *Friedman*-Test p=0.558, NIKav-BUT, *Friedman*-Test p=0.864; red illumination: NIKf-BUT, *Friedman*-Test p=0.763, NIKav-BUT ANOVA p=0.781). Between the illumination there are no statistical differences (p>0,05) apart from two exceptions [NIKf-BUT(ir=r=w) day 2: p=0.01/ day 3: p=0.005; *Friedman*-Test].

Conclusion:

Results of the non-invasive keratograph break-up time (NIK-BUT) on three successive days and between the three different illuminations were equal. The infrared illumination is the least invasive method to measure the NIK-BUT. This is why the illumination is recommended for practical use. The NIK-BUT method, using the three different illuminations, should be optimised in future studies, since the video topographer is detecting eyelashes, pupil light reaction and iris crypts as a tear film break-up.

References:

[1] Korb, D. R. et al.: The tear film. Structure, function and clinical examination. Butterworth-Heinemann, Oxford 2002

[2] Marquardt, Rolf; Lemp, Michael A.: Das trockene Auge in Klinik und Praxis. -1. Aufl.-Heidelberg, Berlin: Springer Verlag 1991.

[3] Goto, T. et al.: A New Method for Tear Film Stability Analysis Using Videokeratography. American journal of Ophthalmology. 2003. 135. 5

contact: jenvis-research.com | Address: JENVIS Research Institute · c/o University of Applied Sciences Jena · Carl-Zeiss-Promenade 2 · 07745 Jena · Germany | Phone: 0049-(0)3641-205870 | E-Mail: j.wittekind@jenvis-research.com