DEWS	**DRY EYE: DIAGNOSTIC TEST TEMPLATE**	
RAPPORTEUR	Carolyn Begley	24th May 2005
TEST	**Tear Breakup Dynamics (TBUD) tests**	
TO DIAGNOSE	Test of tear instability.	
VERSION of TEST	There are two versions of the TBUD test: 1: Staring Tear Breakup Dynamics (S-TBUD) 2: Tasks Tear Breakup Dynamics (T-TBUD).	
DESCRIPTION	1: The S-TBUD is an extension of tear breakup time (TBUT) test. • The subject is asked to "stare" straight ahead for as long as possible while the fluorescent tear film is videotaped. The time from start to finish is the maximum blink interval (MBI). • Subsequent image analysis allows tear stability to be assessed in a masked manner. The TBUT and the spatial location and growth rate of areas of breakup (AB) can be determined. 2: The T-TBUD monitors ABs while subjects perform various visual tasks, such as playing a computer game or reading. • The image analysis methods used are the same as for the S-TBUD.	
STUDY		
CONDUCT of TEST	A slit-lamp biomicroscopic video set-up is required. 1: S-TBUD: • The subject is seated behind the slit-lamp after instillation of 2µl of 2% sodium fluorescein. The experimental eye is voluntarily kept open for as long as possible, until discomfort occurs, similar to a childhood "staring contest." • The other eye is held shut by the subject. • During the trial, the tear film is videotaped. • Later, an analysis of AB in selected frames of the video is performed using a custom MATLAB program. #2: T-TBUD: • Similar to the S-BUD, except that the subject watches a movie, plays a computer game or reads for 3 minutes while tear breakup and the extent of blinking are quantified.	(Begley et al., 2006) (Himebaugh et al. 2001)
RESULTS of STUDY	(1) dry eye subjects show a faster growth rate of ABs than controls (slope of AB/MBI is 4x greater), (2) the slope of AB/MBI is more repeatable than the TBUT, (3) symptoms similar to those of dry eye patients can be generated even in controls after repeated S-TBUD trials without an increase in corneal staining, (4) dry eye subjects showed multiple central ABs in T-TBUD trials, These results imply that tear breakup is rapid and extensive in dry eye subjects, even after the first blink, and that it occurs during normal visual tasks. Increased symptoms secondary to tear breakup, in the absence of corneal staining, suggests that the development of symptoms does not require clinically measurable ocular surface damage.	(Begley et al, 2006) (Liu et al, 2006) (Begley et al, 2006)
Web Video	Not available	
Materials:	• 2% sodium fluorescein, slit lamp biomicroscope, video set-up, custom computer program	
Standardization	Time of day [√] Temperature [√] Humidity [√] Air speed [√] Illumination [√]	

Diagnostic value	This version : [x] The slope of AB/MBI is steeper in dry eye compared to controls.	Begley et al., 2006
Repeatability	Intra-observer agreement.[ ] Inter-observer agreement. [ ] Not applicable because test is not based on observers	
Sensitivity	(true positives) [80% sensitivity] Our submitted manuscript indicates 80% sensitivity and specificity for S-TBUD in a small group of subjects. We have not performed this analysis on T-TBUD.	Begley et al., 2006
Specificity	(100 – false positives) [80% specificity] see above	
Other Stats		
Test problems	The test requires good videotapes with no shadows. Auxiliary lighting is sometimes needed.	
Test solutions	In a clinical trial setting, investigators would need to be trained to obtain good quality videos.	
FORWARD LOOK	Increased programming to move directly from video to results.	
Glossary	MBI: Maximum Blink Interval S-TBUD: Staring Tear Breakup Dynamics T-TBUD: Tasks Tear Breakup Dynamics	

References

Begley CG, Himebaugh N, Renner D, et al. Tear breakup dynamics: a technique for quantifying tear film instability. *Optom Vis Sci* 2006;83(1):15-21.

Himebaugh N, Renner D, Begley C. Blink rate, fullness of blink, and tear film break-up with four different visual tasks. *Optom Vis Sci* 2001;78(12s): 121.

Liu H, Begley CG, Chalmers R, et al. Temporal progression and spatial repeatability of tear breakup. Optom Vis Sci *2006*;83(10):723-30.