DEW	DRY EYE: DIAGNOSTIC TEST TEMPLATE	
RAPPORTEUR	Eiki Goto, MD	15th March 2006
TEST	**Tear film lipid layer interferometry**	
TO DIAGNOSE	Aqueous tear deficient dry eye (ATD) or precorneal lipid tear deficiency.	REFERENCES
VERSION	[V6]	Goto et al, 2003
DESCRIPTION	Superficial tear lipid layer is observed with tear interference camera. Interference images are graded on dry eye severity or analyzed to quantify lipid layer thickness. References: Korb and Greiner, 1994; King-Smith et al. 1999; Yokoi et al. 1996; Mathers et al. 1997; Goto et al. 2003;	
CONDUCT of TEST	*1.* The subject is seated comfortably at the tear interference camera and the head positioned on the chin rest. . 2. With the eyes in normal blinking interference images are monitored. 3. After a few seconds of blinking, when the interference image becomes stable, the image is captured. 4. Lipid layer thickness is estimated using a colour comparison table (Korb and Greiner). 5. Interference images are semi-quantitatively graded on the pattern and colour.(Yokoi et al) 6, In a kinetic analysis, interference images are recorded on a video over several natural blink intervals for 30 seconds. In a representative blink interval, *lipid spread time* from eye opening to the cessation of lipid movement is measured. (Goto and Tseng) 7. When image analysis is needed, the captured, still, interference image is analyzed by its colour profile. Lipid layer thickness is quantified with the colour chart system. (Goto et al)	Doane, 1989; Korb and Greiner 1994; Yokoi et al 1996; Goto and Tseng, 2003 Goto et al 2003 Korb et al 2005
Web Video	Not available	
Materials:	• Tear interference camera (DR-1(Kowa, Nagoya, Japan), Dr.Korb's camera, Dr.Doane's camera or Tearscope (Keeler, Windsor) • Digital printer • Hopefully PC for image capturing	Yokoi et al, 1996 Goto and Tseng, 2003
Standardization	Time of day[√] Temperature[√] Humidity[√] Air speed[√] Illumination[√] Other:[blinking √]. Assumed to influence	
Variations of technique	V1, Tear lipid layer interference images were observed using devices such as Tearscope. V2, Lipid layer thickness was estimated using color comparison method. V3, Images were captured using modified specular microscope and graded on dry eye severity in Sjogren syndrome. V4, Interference camera was sophisticated (DR-1, Kowa, Japan) and images were graded on dry eye severity. V5, Kinetic analysis of interference images using DR-1 to measure lipid spread time. V6, Precorneal lipid layer thickness was quantified using colorimetric system in DR-1. V7, Lipid layer thickness topography was processed. * Tear interference patterns on contact lens are also evaluated by Guillon or Maruyama.	Guillon,1992 Korb and Greiner, 1994 Danjo and Hamano, 1995 Yokoi et al, 1996 Tiffany et al,2001 Goto and Tseng, 2003 Goto et al, 2003 Goto et al, 2004 Maruyama et al, 2004
Diagnostic value	See references 4 and 5.	Yokoi et al, 1996 Yokoi et al 1999
Repeatability	Intra-observer agreement. [+], V4 on grading and V5 on grading and Kinetic analysis	Yokoi et al, 1996 Yokoi et al 1999

	Inter-observer agreement. [-]	Goto and Tseng, 2003 Goto and Tseng, 2003
Sensitivity	**(true positives)** [-]	
Specificity	**(100 – false positives)** [-]	
Other Stats		
Test problems	a. Colour intensity of interference images are influenced by the refractive indices of tear lipid and aqueous layers and specular angle. b. Interference images are influenced by how to blink, thus to record the non-invasive status of the lipid layer, it is important for the subject to blink naturally. c. Lipid quality could not be indicated by interferometry. d. Amount of meibum secretion observed at lid margin does not always correlate with the precorneal lipid layer thickness (a phenomenon, not a test problem)	Goto et al, 2003 King-Smith et al, 1999 Tiffany, 1986
Test solutions	*a.* Image analysis for lipid thickness quantification need to be developed more.	
FORWARD LOOK	a. Identify cut-off for MGD, and ATD diagnosis. b. Incorporate MGD diagnosis into diagnosis of evaporative dry eye or precorneal lipid deficiency. c. Image analysis on raw interference image and quantification of lipid layer thickness in a mapping form. Clinically useful index from mapping for comparison and stats.	
Glossary	ATD = Aqueous tear deficient dry eye	

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