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Dry Eye Workshop
Puerto Rico 2004

Tear Film Committee 25th November 2004
Diagnostics Group

Dear Colleague,

I am writing on behalf of the Tear Film Diagnostics Group to solicit your help in preparation for the forthcoming Dry Eye Workshop.

We have prepared a list of tests used in dry eye diagnosis and would like you to provide information about a small number of these, acting as a rapporteur. In order to spread the load and widen the expertise base, we have cut across the DEW committee boundaries. Please accept our apologies.

You will find your name in the list of rapporteurs on page 2, together with the suggested test or tests.

A full list of tests is given on pages 3-5 indicating the names of all rapporteurs. If you notice that we have omitted tests of obvious importance please e-mail me and we will take this on board.

Page 6 provides a template/proforma into which you can enter details about each test, with sections in which to record: the test name; version of test; reference citations; diagnostic use; brief description; conduct of the test; materials required; aspects of standardisation and statistics supporting its value, etc. Page 7-8 shows a mock example of the template, filled in for meibometry.

I would appreciate it if you would complete several templates, using as many as required to cover the topic. Please call your preferred version of the test "version 1", providing the most details and the relevant references. Other versions may be cited in less detail, on further templates. Where information is lacking, please leave the relevant section empty.

Please regard your submission as a draft, which can be updated later. The purpose of the exercise, in the first instance, is to obtain a broad overview of each topic.

Thanks for your help. I look forward to receiving your submission.

With Kind Regards,

Professor A. J Bron
Professor Emeritus

Invited Rapporteurs

Rapporteurs	Diagnostic test area	
Abelson- Mark and Ousler	Standardizing test conditions for dry eye tests Break-up tests (Fluorescein and non-invasive) Ocular Protection Index	
Baudouin- Christoph	Flow cytometry	
Begley -Carolyn	Tear dynamics tests	
Beuerman- Roger	Inflammatory mediators Tear Proteomics	
Bron- Tony	Grading ocular surface staining Schirmer Tests I and II and reflex Schirmer's	
Caffery- Barbara	Symptom questionnaires	
Dogru- Murat	Hamano thread Non-invasive Tear Stability Analysis. TSAS	
Foulks- Gary	Grading meibomian morphology; expressed oil, Meibography	
Goto-Eiki	Tear film interferometry	
Grus - Franz	Tear Proteomics (additional version)	
Korb-Donald	Blink measurements in relation to dry eye	
Lemp-Mike	Tear Osmometry Confocal microscopy	
Mathers-Bill	Meibomian morphology and grading expressed oil.	
McCulley-Jim	Standardizing Meibomian oil collection. Diagnostic value of lipid chemistry findings	
Murube-Juan	Sjogren's Syndrome Serological tests Salivary function tests	
Nelson-Dan	Impression cytology	
Pflugfelder-Steve	Tear turnover: simple clinic test. Visual function in dry eye: Wavefront analysis Dysfunctional Tear Syndrome: key tests.	
Rolando-Maurizio	Ferning test	
Shimazaki-Jun	Tests which differentiate dry eye from eye allergy	
Sullivan-David	Systemic endocrine features of dry eye	
Tiffany-John	Meibometry	
Toda- Ikuko	Tear function Index Minor salivary gland biopsy.	
Tomlinson-Alan	Fluorimetry: Tear flow, volume; turnover	
Tsubota-Kazuo	Evaporimetry in tear film deficiency/MGD diagnosis; in dry eye diagnosis	
Watanabe-Ni	Mucins in dry eye diagnosis	
Willcox-Mark	Tear proteins: eg Lactoferrin; lysozyme. Meniscus height, cross-sectional area	
Wilson-Steve	Diagnosis of post-LASIK 'dry eye' / 'neuro-epitheliopathy'	
Yokoi-Norihiko	MeniscometryL radius of curvature. Conjunctivochalasis	

Provisional list of diagnostic tests for dry eye and related disorders including invited rapporteurs.
Please inform Tony Bron of tests which you think should be included, so that they can be added to the list. (anthony.bron@eye.ox.ac.uk).

DIAGNOSTIC TESTS FOR DRY EYE

COMPONENT	TEST	RAPPORTEUR	REFERENCES
STANDARDISATION	General	Abelson	
SYMPTOMS	Questionnaires	Caffery	
	NEI VQ 25		
	McMonnies		
	Schein		
	Mc Carty		
	OSDI		
	DEQ		
AQUEOUS TEARS			
Tear Volume			
	Fluorimetry	Tomlinson	
	Hamano thread	Dogru	
	Meniscus		
	Radius of Curvature	Yokoi	
	Height	Willcox	
	Area of cross-section	Willcox	
	Volume		
	Tear film thickness		
Tear flow			
	Fluorimetry	Tomlinson	
	Schirmer I	Lemp	
	Dynamic Schirmer		
	Schirmer II	Lemp	
	Reflex Schirmer	Lemp	
	Electronic Schirmer		
	Lacrimal Equilibration		
	Tear turnover		
	Practical clinic test	Pflugfelder	
	Fluorimetric	Tomlinson	
	Dye dilution		
Tear Evaporation			
	Evaporimetry	Tsubota	
	Interaction with blink		
Tear Stability and Visual Function			
	Fluorescein BUT	Abelson	
	Non-invasive BUT	Abelson	
	Tear thinning time		
	Topographic analysis		
	TSAS	Dogru	
	Wavefront analysis	Pflugfelder	
	Tear dynamics teststs	Begley	

Tear Composition	Standard aqueous collection technique		
Biological fluids	Aqueous Tears		
	Lactoferrin	Willcox	
	Lysozyme	Willcox	
	peroxidase		
	IgA		
	ceruloplasmin		
	Inflammatory mediators	Beuerman	
	IL-1		
	MMPs		
	Other proteins		
	For proteomics	Beuerman	
		Grus	
	Mucins	Watanabe	
	Lipids	See below	
Cells in biofluids			
	Inflammatory cells		
	Epithelial cells		
	Tear debris	Nichols	
Surface cells			
	Impression cytology	Nelson	
	Flow cytometry	Bauduoin	
	Brush cytology	Tsubota	
	Confocal microscopy	Lemp	
MEIBOMIAN FUNCTION	Standard lipid collection technique	McCulley	
	Evaporimetry	Tsubota	
	Interferometry	Goto	
	Meibometry	Tiffany	
	casual		
	delivery		
	Meibography	Foulks	
	MGD morphology	Mathers	
	Expressed oil volume and quality	Mathers	
	Lipid Chemistry	McCulley	
Tears: Physical behaviour			
Osmolality		Mathers	
	depression of freeze point		
	vapour pressure osmometry		
	conductivity		
	electrolyte composition		
Tear Ferning		Rolando	

Surface Damage			
Grading staining	Fluorescein	Bron	
	Rose Bengal		
	Lissamine green		
	Double staining		
OTHER CRITERIA			
	Tear Function Index - TFI	Toda	
	conjunctivochalasis	Yokoi	
	Blink characteristics	Korb	
	Distinction from allergy	Shimazaki	
SJÖGREN'S SYNDROME	**Serological tests**	Murube	
	Anti-Ro		
	Anti-La		
	Anti-M3 receptor		
	Anti fodrin		
	other		
	Minor Salivary gland biopsy	Toda	
	Lacrimal gland biopsy		
	Systemic endocrine findings	Sullivan	
	Tests of Salivary function	Murube	
	Biscuit		
	Other		
	Sialography		
Tests for assorted disorders			
Wegener's	Positive ANCA-		
Rheumatoid Arthritis.	Positive Rh F – Rh Arthr.		
SLE			
LASIK 'dry eye' Neuro-epitheliopathy		Steve Wilson	
Dysfunctional Tear Syndrome		Pflugfelder	

Here is a proforma into which you can enter the details of your test: This can be copied for all tests or versions of a test.

DEW	**DRY EYE: DIAGNOSTIC TEST TEMPLATE**	
RAPPORTEUR	Please insert your name.	Date:*DDNov 2004*
TEST	***Name of test: eg Schirmer I***	
TO DIAGNOSE	*Test used to diagnose – eg. aqueous tear deficiency (ATD).*	REFERENCES
VERSION of TEST	[V] *Please call your preferred version, version 1. Other versions should be submitted on separate templates and numbered, not necessarily in priority order.*	*Please reference the source of this version.*
DESCRIPTION	*This should be a one or two line statement saying what the test is for.*	
NATURE of STUDY	If you wish to refer to a specific study in detail, enter the details here.	
CONDUCT of TEST	*Please describe all steps of the test in sufficient detail to provide a template for a trainer.*	
RESULTS of STUDY	If you have described a specific study in detail, place the results here	
Video needed	Yes: [ ] No: [ ] *If instruction would be aided by a video of the technique, please tick this video box.*	
Materials:	• *Please list the nature and sources of materials used for the test as described*.	
Variations of technique		
Standardisation	Time of day [ ] Temperature [ ] Humidity [ ] Air speed [ ] Illumination [ ] Other:[ ] *Tick the boxes if you think that such standardization would improve the repeatability of the test.*	
Diagnostic value	This version : [ ] *Please state if these stats relate to* Other version: [ ] *this version or another cited version.* *Please cite statistics indicating the diagnostic value of the test.*	*Please cite reference to stats used*
Repeatability	Intra-observer agreement. [ ] Inter-observer agreement. [ ]	
Sensitivity	**(true positives)** [ ]	
Specificity	**(100 – false positives)** [ ]	
Other Stats	*If you have other stats for this, or related versions of the test, please add as many rows as necessary and cite the reference.*	
Test problems	*Is there a problem with this test?*	
Test solutions	*Can you suggest an improvement?*	
FORWARD LOOK	*What future developments do you foersee?*	

References

Here is a mock example of the completed proforma, showing the assessment of a test for MGD, using Meibometry.

DEW	**DRY EYE: DIAGNOSTIC TEST TEMPLATE**	
RAPPORTEUR	John Doe or Richard Roe	Date: *01/Oct/04*
TEST	MEIBOMETRY: **Casual, or Steady State Level**	
TO DIAGNOSE	*Meibomian Gland Dysfunction - (MGD)*	REFERENCES
VERSION of TEST	[V*1*]	*Komuro et al. 2002*
DESCRIPTION	*Lipid on the lower central lid margin is blotted onto a plastic tape and the amount taken up read by optical densitometry. This provides an indirect measure of the steady state leve of meibomian lipid.*	
CONDUCT of TEST	*1.The subject is seated, with the head resting comfortably at the slit-lamp.* *2.With the eyes in upgaze, the right lower lid is drawn down lightly without pressure on the tarsal plate.* *3. A standard loop of plastic tape, held in an applanation or ultrasonography probe holder, is applied to the central third of the everted lid margin for 3 seconds, at 0 mmHg.* *4.The tape is air dried for 3 minutes to allow tear evaporation if necessary.* *5.The increase in transparency induced by the lipid blot, is read in the laser meibometer.* *6. The Casual Lipid level (expressed as arbitrary optical density units) is calculated as (C-B/A), where C is the casual reading, B is the reading from the untouched tape and A is the reading in the absence of the tape.*	*Komuro et al. 2002*
Video need	Yes: [*x*] No: [ ].	
Materials:	• *Plastic tape: 8 mm wide (Courage and Khazaka, Köln)* • *Tape Holder:(eg. NIDEK ultrasonographic probe holder.* • *Laser Meibometer. Window size (2.5 x 5.0 mm^2)*	
Standardisation	Time of day [x] Temperature [ ] Humidity [ ] Air speed [ ] Illumination [ ] Other:[ ] *The level is highest in the first hour after waking.*	
Variations of technique	In the original version, [V2] optical density was read using an adaptation of the Courage and Khazaka sebumeter. A point reading was taken at the center of the blot. Other methods exist in which the blot is scanned and the increase in transparency is integrated over the length of the blot .	*Chew et al. 1993* **Yokoi et al 1999**
Diagnostic value	This version : [ ] Other version: [2] *Please cite statistics indicating the diagnostic value of the test.*	*Yokoi et al 1999*
Repeatability	Intra-observer agreement. [-] Inter-observer agreement. [-]	

Sensitivity	**(true positives)** [-]	
Specificity	**(100 – false positives)** [-]	
Other Stats	*If you have stats for related versions of the test, please add as many rows as necessary and cite the reference.*	
Test problems	**a. In normal subjects the lipid blot is uniform and results can be extrapolated to the total lid length.** *In MGD, focal gland obstruction may vary along the lid length so that central readings may not truly reflect the overall picture.* *b. Calibrations and assumptions are required to convert raw densitometry readings into meibomian lipid equivalent values.*	
Test solutions	*a. Measurement should be made along the whole of the lower lid length in order to reflect variation in MGD.*	
FORWARD LOOK	a. Develop a system to integrate lipid along full lid length. b. Identify cut-off for MGD diagnosis. c. Incorporate MGD diagnosis into diagnosis of evaporative dry eye.	

References: ***Please list any references cited. Do not use a reference manager. eg:***

Chew CKS, Hykin PG, Jansweijer C et al. The casual level of meibomian lipids in humans. *Current Eye Research* 1993c; **12**: 255-9.

Komuro A, Yokoi N, Kinoshita S et al. Assessment of meibomian gland function by a newly developed laser meibometer. *Adv Exp Med Biol.* 2002; **506**: 517-20.

Yokoi N, Mossa F, Tiffany JM et al. Assessment of meibomian gland function in dry eye using meibometry. *Ophthalmol.* 1999; **117**: 723-9.