EYELID PROCEDURES

AUTHOR

Luigi Bilotto: Brien Holden Vision Institute

PEER REVIEWERS

Meng Meng Xu, The New England College of Optometry

TEAR MENISCUS (PRISM)

The measurement of the tear meniscus helps evaluate the tear volume.

PROCEDURE

- With the SL assess the height of the tear prism
- If possible measure using the reticule
- Compare the height between the two eyes
- Assess prior to manipulating the lids
- Use low lighting and high magnification
- Perform prior to instillation of medications
- Avoid bright light as it may stimulate reflex tearing.

INTERPRETATION

Average 0.4mm
Insufficient < 0.3mm
Ideal > 1.0mm
Gray Zone 0.3 – 1.0 (possible dry eye; consider patient's symptoms)
Compare OD vs. OS

Normals: the border of the meniscus is straight or convex
Abnormal: the border may appear irregular or scalloped

NONINVASIVE BREAK UP TIME (NIBUT)

NIBUT evaluates tear film stability which is primarily a function of the mucin layer without the use of dye or any device placed in the eye.

Keratometer or Xeroscope (an instrument that projects a grid pattern).

PROCEDURE

- No dye, no medication is placed in eye
- Instruct patient to blink several times
- Direct their gaze straight ahead
- Observe the mires or grid pattern
- Measure the time in seconds from the last blink to the development of the first discontinuity in the mires or grid pattern.

INTERPRETATION

Abnormal < 5 seconds
Ideal > 10 seconds
Gray Zone 5-10 seconds (possible dry eye; consider patient's symptoms)

TEARSCOPE

The tearscope is an instrument used in conjunction with a slit lamp to evaluate the pre-ocular tear film (POTF) and pre-lens tear film (PLTF).

PROCEDURE

- Patient is seated at SL
- Turn off the SL illumination / turn on the tearscope illumination
- Magnification at least 20X
- Hold tearscope in front of the observation system close to the patient's eye
- Focus on the POTF
- Measure the NIBUT and observe the tear film (TF) patterns
- To measure NIBUT, have patient blink and use the instrument's digital timer to time the appearance of the first dry spot.

INTERPRETATION

NIBUT
Marginal dry eye < 10 sec
Borderline dry eye 10- 20 sec
Stable tear film >20 sec

Tear Film Patterns (Compare to photos on Recognition Chart)

No apparent lipid layer:	abnormal unstable tear film
Open meshwork:	normal POTF with thin lipid coverage
Close meshwork:	normal POTF with lipid coverage thicker than open meshwork
Wave (flow):	normal POTF most common good lipid coverage
Amorphous:	normal POTF most stable lipid coverage
Color-fringe:	normal POTF with thick lipid coverage

INVASIVE TEAR BREAK UP TIME (TBUT)

TBUT evaluates the tear film stability which is primarily a function of the mucin layer.

PROCEDURE

- Place the fluorescein in the eye
- Avoid using excess fluid by shaking NaFl strip well before instillation
- Instruct patient to blink several times
- Direct them in the SL with their gaze straight ahead
- Observe the tear film using moderate magnification
- Measure the time in seconds from the last blink to the development of the first dark dry spot on the cornea
- Repeat 3 times and average.

INTERPRETATION

Abnormal < 5 seconds
Ideal > 10 seconds
Gray zone 5-10 seconds (possible dry eye; consider patient's symptoms)

FLUORESCEIN STAINING

NaFl staining evaluates interpalpebral ocular surface integrity.

PROCEDURE

Fluorescein dye is instilled in the eye to assess the presence of staining erosions, abrasions or mucus.

INTERPRETATION

Fluorescein staining indicates the presence of eroded epithelial cells and mucus which commonly result from dry eye. The staining pattern is characteristically, but not always, observed in the **interpalpebral** region where the eye is most exposed.

ROSE BENGAL

Rose bengal (RB) helps evaluate ocular surface integrity by staining **devitalized cells** and mucus strands. In dry eye assessment, this is more advantageous than NaFl because it stains cells at an earlier degenerative stage. Dry eye may therefore be detected earlier.

PROCEDURE

With RB dye in the eye, note the presence of staining erosions, abrasions or mucus filaments especially in the interpalpebral zone.

Note: Because RB may sting upon instillation, some sources recommend the use of anaesthetic. Instillation of anesthetic, however, may disrupt the ocular surface and cause false positive staining. We therefore do not recommend its use.

INTERPRETATION

RB staining indicates the presence of degenerated epithelial cells and mucus which commonly result from dry eye. The staining pattern is characteristically, but not always, observed in the **interpalpebral** region where the eye is most exposed.

LISSAMINE GREEN STAIN

The Lissamine green stain evaluates ocular surface integrity. Lissamine green is similar in function to RB because it will stain degenerated cells and mucus strands/filaments. Lissamine green has the advantage over RB in that it does not sting on instillation. Lissamine green is now commercially available.

PROCEDURE

With Lissamine green dye in the eye, note the presence of staining erosions, abrasions or mucus especially in the interpalpebral zone. Grade the staining using the same scale as NaFl and RB and **DRAW** the location!

INTERPRETATION

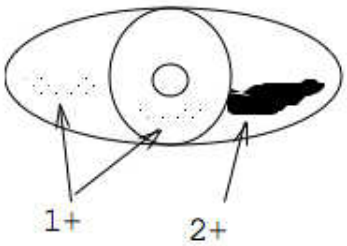
Lissamine green staining indicates the presence of degenerated epithelial cells and mucus which commonly result from dry eye. The staining pattern is characteristically, but not always, observed in the **interpalpebral** region where the eye is most exposed.

Documentation of Staining

Clinically one can use available charts such as the CCLRU grading scale to grade the observed staining. In the absence of these, however, one can use the following scale.

Grading	Location
0 = No staining 1+ = Mild staining 2+ = Moderate staining 3+ = Marked/severe staining	DRAW!

e.g.



SCHIRMER TEST

The Schirmer test measures the volume of the aqueous layer and the ability of the lacrimal glands to produce aqueous. A special filter paper is inserted under the lids to collect and assess the tears produced by the eye. The test can be performed in 3 ways:

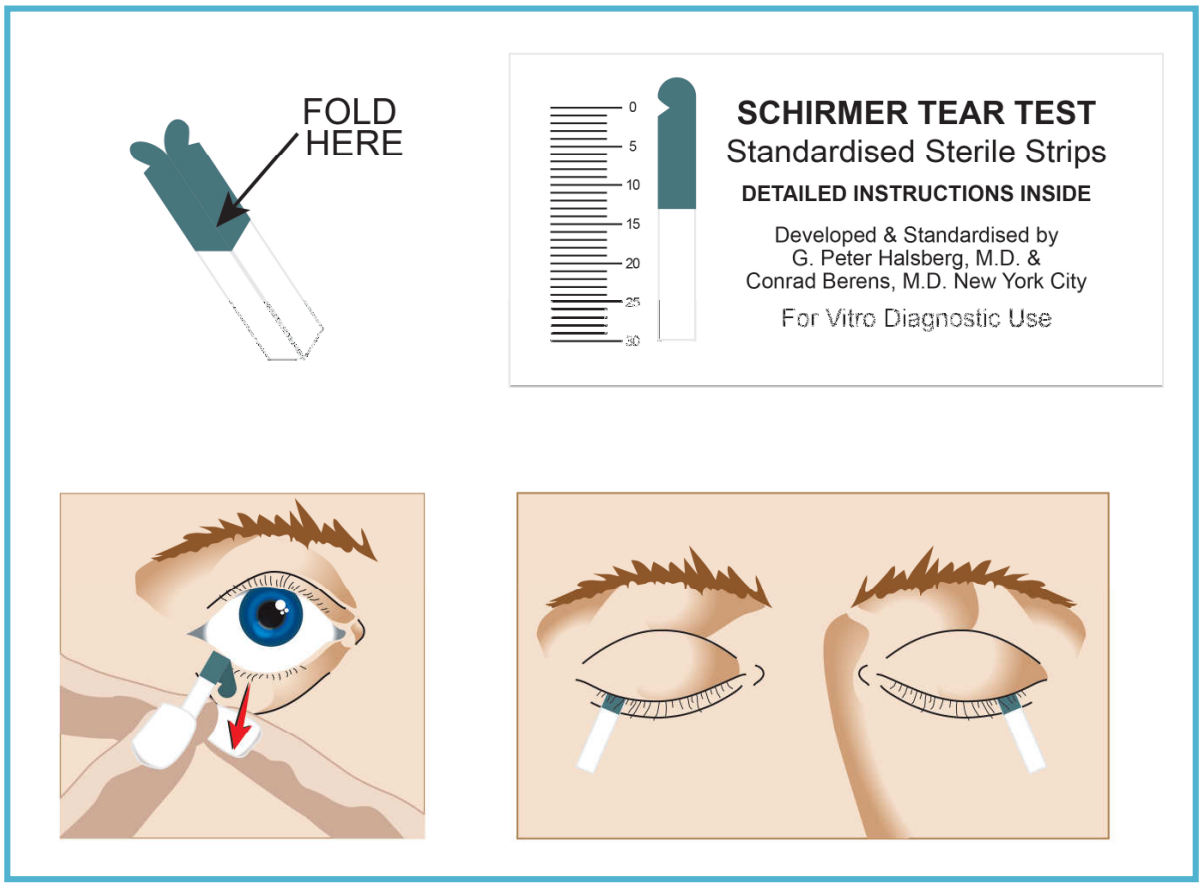


Fig 7.1 *Schirmer test*

Inspired by Fingeret M, et al. Atlas of Primary Eyecare Procedures. Norwalk, CT: Appleton and Lange; 1990.

Schirmer # 1 Without Anaesthetic

- Bend paper strip at 5mm indent without touching strip directly (use instrument)
- Grasp end of paper with jeweller's forceps to avoid oils from the fingers to alter test paper
- Bend at 5mm indent
- Place in inferior cul-de-sac at lateral edge of lid
- The patient can look straight ahead and blink normally
- The patient can also look down or gently close their eyes during test
- Leave in place for five minutes
- Remove paper strip
- Measure/record in millimeters the length of wetness from the bend.

Schirmer # 1 With Anaesthetic/Basal Secretion

- Anaesthetic is instilled several minutes prior to testing. This reduces reflex tearing.
- Bend paper strip at 5mm indent without touching strip directly (use instrument)
- Grasp end of paper with jeweler's forceps to avoid oils from the fingers to alter test paper
- Bend at 5mm indent
- Place in inferior cul-de-sac at lateral edge of lid
- The patient can look straight ahead and blink normally
- The patient can also look down or gently close their eyes during test
- Leave in place for five minutes
- Remove paper strip
- Measure/record in millimeters the length of wetness from the bend.

Schirmer # 2 With Anaesthetic and Nasal Mucosa Stimulation

- Anaesthetic is instilled several minutes prior to testing
- Bend paper strip at 5mm indent without touching strip directly (use instrument)
- Grasp end of paper with jeweler's forceps to avoid oils from the fingers to alter test paper
- Bend at 5mm indent
- Place in inferior cul-de-sac at lateral edge of lid
- The patient can look straight ahead and blink normally
- The patient can also look down or gently close their eyes during test
- Cotton swab inserted into nasal mucosa and gently rotated to stimulate reflex tearing
- Leave in place for two minutes
- Remove paper strip
- Measure/record in millimeters the length of wetness from the bend.

INTERPRETATION

#1 Without Anaesthetic	#1 With Anaesthetic	#2 Anaesthetic and Nasal Mucosa Stimulation
Basal and reflex tear secretion	Basal tear secretion only	Separates basal and reflex tear secretion
5 minute test time **Abnormal <10mm – 15mm**	5 minute test time **Abnormal < 10mm**	2 minute test time **Abnormal <15mm**

Note: A variation of the Schirmer tear test is the **Color Bar Schirmer Tear Test** by Eagle Vision. The test paper is impregnated with a dye which turns blue when it comes in contact with tears. Additionally a millimeter scale is printed directly on the strip to facilitate readings.

MEIBOMIAN GLAND FUNCTION (MGF)

MGF is the last test to be performed because expressing lipids from the lid margin can alter other testing. In normal functioning meibomian glands, lipid is released upon each blink. The lipid should be released along the entire lid margin and it should appear clear like “baby oil”.

PROCEDURE

Gently express the glands digitally or with a cotton swab by applying pressure on the lid from base to margin. Note signs of clogging or milky fluid expressed from glands.

INTERPRETATION

A clear oily fluid should emerge from the orifices of the gland. Apparent clogging of the glands or expression of a “tooth paste” like material may indicate Meibomian Glands Dysfunction (MGD).

COTTON THREAD TEST

The Cotton Thread Test measures the volume of the aqueous layer. A special sterile yellow cotton thread is used instead of a paper strip. The thread is impregnated with phenol red dye, which makes the yellow thread turns red when wet by tears. Less invasive and irritating than the paper tear strip, it reduces the stimulation of reflex tearing. The test may therefore be better to measure basal tear secretion. Recently FDA approved, it is now commercially available.

PROCEDURE

- The cotton thread (70mm) is bent 3mm at the end using jewelers forceps
- The thread is placed in the inferior cul-de-sac temporally
- Test time is 15 seconds
- Remove thread
- Record in mm the length of red thread from the bend.

INTERPRETATION

Normal: 9 - 20mm
Symptoms of dryness correlate to measurements **<9mm**

TEAR FILM OSMOLARITY

Tear Film Osmolarity is performed to grade the osmolarity of the tear film. In patient's with tear deficient dry eye (TDDE) and evaporative dry eye (EDE), tear film osmolarity may be increased when compared to normals. This is due to the fact that less aqueous content within the tears produces a higher concentration of electrolytes within the tear film. Increased tear osmolarity usually occurs prior to Rose Bengal staining of the cornea and conjunctiva. Unfortunately, this test is limited by availability of instrument.

PROCEDURE

- Tears are collected by capillary action into a glass micropipette
- The sample is then analyzed using an instrument termed an osmometer
- The osmometer correlates the freezing point of the sample to osmolarity.

INTERPRETATION

Normal: ~ **300 mOsm/kg**
Abnormal: 312 - 330 mOsm/kg

TEAR PROTEIN ANALYSIS

Lysozyme Assay is an immunologic laboratory test of lacrimal gland function which measures the amount of lysozyme within the tears. Lysozyme constitutes ¼ of the protein within the tear film. The amount of lysozyme may be reduced in a patient TDDE compared to the normal population. This test is limited by the availability of laboratory materials.

PROCEDURE

- A tear sample is taken by placing a filter paper disc in the inferior cul-de-sac
- The disc is placed on an agar plate which contains Micrococcus lysodeiktics
- The zone free of bacterial growth surrounding the disc is then measured.

INTERPRETATION

The measurement indicates the amount of lysozyme present in the tears. The quantity of lysozyme within the tears decreases correspondingly with a decrease in lacrimal gland function.

The Lacoferrin Assay is an immunologic laboratory test of lacrimal gland function which is performed by the lactoplate method and the lactocard method. It measures the amount of lactoferrin within the tears. Lactoferrin is a protein found within the tear film. The amount of lactoferrin may be reduced in a patient with TDDE compared to the normal population. The tests are limited by the availability of laboratory materials.

Lactoplate method

- A tear sample is taken by placing a filter paper disc in the inferior cul-de-sac
- The disc is placed on an agar plate containing rabbit anti-sera to human lactoferrin
- The ring of precipitate is then measured

INTERPRETATION

Normal 1.42 mg/ml
Abnormal <1 mg/ml

Lactocard method

- A tear sample is taken by using a glass capillary tube
- The sample is analyzed as a solid phase ELISA test
- The analysis instrument is a reflectance spectrometer

HISTOLOGIC TESTING

TDDE and EDE patients may suffer the effects of ocular surface disease which may include epithelial squamous metaplasia or keratinization of the epithelial mucosa. Therefore, histologic tests have been developed to examine these ocular manifestations.

Conjunctival Impression Cytology (CIC) is used to measure squamous metaplasia of epithelial and goblet cells of the conjunctiva in patients with dry eye. The tissue sample is taken by placing a paper filter disc in the inferior conjunctiva. The discs are then removed and placed on slides. With the use of histologic dyes the slides are then examined microscopically . The test is limited by availability of laboratory materials.

Brush cytology measures the keratinized cell population of the conjunctiva in patients with dry eye. Samples are taken from the temporal bulbar conjunctiva with a cytobrush. They are placed on a filter which is stained histologically and examined microscopically. The test is limited by availability of laboratory.