Lissamine green

Claire McDonnell looks at lissamine green dye, its action and its use. Module C13232, one general CET point suitable for optometrists and one IP point for independent prescribers

Lissamine green (LG) is a vital stain which stains membrane degenerate cells, dead cells and mucus. It is replacing rose bengal (RB) as the premier dye for conjunctival staining. Similar to RB, LG is not very visible within the tear film, and therefore any dye in the tear film does not obscure any staining pattern that is present. It is not as effective as fluorescein (FL) for investigation of corneal staining.

LG is available in impregnated paper strips containing 1.5mg of the dye (Figure 1). A drop of sterile saline is added to the strip and the dye is placed into the lower fornix of the eye by capillary action. It is important to instill a sufficient volume (10-20μl ie more dye than with FL) and then ask the patient to blink gently to allow adequate staining. Dry eye researcher, Gary Foulks recommends allowing at least a minute and no more than four minutes to show optimum staining. Viewing too soon does not allow full development of staining patterns and waiting too long means that some of the pattern may fade. Some researchers advise assessing one eye at a time to prevent it being under-reported in the second eye. The level of illumination under which the staining is viewed is also important. High illumination will bleach out some of the appearance of staining. It is recommended that initial viewing is with low illumination which is increased until observation of any staining is optimal. The staining is enhanced if a red filter (Wratten no 25 equivalent) is used as a barrier filter on the slit lamp (Figure 2).

Lissamine green and rose bengal LG and RB have been found to have similar staining patterns but RB causes ocular discomfort and can be difficult to get out of the eye. These problems do not usually occur with LG (See box on page 30).
Lissamine green and fluorescein
According to research published in Eye and Contact Lens in 2007 researchers found that the early stages of development of dry eye often only show up with LG and were not always readily apparent with FL² (Figures 3a and 3b). LG is key to diagnosing dry eye syndrome in patients whose signs and symptoms appear inconsistent.

Conjunctival staining patterns with lissamine green
Nasal interpalpebral bulbar conjunctival staining is the most common staining observed but this is not necessarily a clinically significant predictor of dry eye as many patients can exhibit these patterns from environmental factors such as pollution. The next stage of conjunctival staining is when the temporal bulbar conjunctiva is also affected and this is a more potent diagnostic of dry eye. Inferior conjunctival staining often coexists with lid margin disease.

Conjunctival staining is important because it occurs sooner than corneal staining and it lasts longer. Contact lenses can cause conjunctival changes prior to any corneal changes. Contact lens wearers who have had previous episodes of CLARE in particular are more likely to have a greater conjunctival response to CL wear compared to those who have not had previous inflammatory disease.³

Corneal staining with lissamine green
Although corneal staining does occur with LG (Figure 4), it is much more difficult to view than with FL. It is a little more visible against light coloured irides compared to brown irides. Significant corneal staining with LG is really only seen when the patient has a Sjögren’s type dry eye.

Lissamine green and the lids
LG is also particularly good for detecting lid margin staining (Figure 5) because unlike FL it does not stain the tarsal plate,
making it difficult to detect staining patterns. Also it does not rub off as easily if the fingers rub against it on lid eversion. The visibility of Marx’s line is enhanced with LG compared to FL (Figures 6a and 6b), making it a more appropriate dye for use in the investigation of chronic meibomian gland dysfunction.

Optimum use of fluorescein and lissamine green combined

There is some debate as to whether LG should be used before FL or vice versa and indeed some investigators have tried a combination of the two instilled simultaneously. Korb et al reported that a mixture of 2 per cent fluorescein and 1 per cent lissamine green offers excellent simultaneous corneal and bulbar conjunctival staining and could replace the use of individual dyes for ocular staining and contact lens practice.4 If LG is used first it is claimed that this can affect subsequent tearbreakuptimes measured with FL. It is thought that any part of the cornea stained with LG will show a more rapid break up than would have occurred in the absence of prior LG instillation.

Use of lissamine green

It is recommended that this dye be used in dry eye assessment, examination of prospective CL wearers (particularly with skin conditions), symptomatic CL wearers, further investigation of any patient with FL staining and in refractive surgery preoperative assessments.

References

4 Korb DR, Herman JP, Finnemore VM, Exford JM, Blackie CA. An evaluation of the efficacy of fluorescein, rose bengal, lissamine green, and a new dye mixture for ocular surface staining. Eye Contact Lens, 2008; Jan:34(1):61-

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Sodium fluorescein

This is a hydroxyanthene dye that fluoresces in the presence of short wavelength light. The level of fluorescence is pH dependent and fluorescein maximally in a more alkaline medium. It fluoresces less in acidic or too alkaline a medium. It is fully ionised in tears and therefore unable to pass through intact biological membranes. It therefore is useful in filling gaps between tissues, as in an abrasion, in entering damaged cells and in penetrating intercellular space. It has no intrinsic toxicity, though practitioners do well to remember the affinity to the dye of pathogens such as Pseudomonas.

Rose bengal

This is also a hydroxyanthene dye of a similar molecular structure to fluorescein. Additional halides give it its red colour and also render it toxic. This toxicity is further enhanced by exposure to visible light. Rose bengal is well known to stain dead and devitalised cells but is now known to also stain healthy cells, with particular preference for the nuclear component. The dye causes significant discomfort on application and, if spilled over onto the cheek, can result in unsightly and persistent staining of the skin.

Lissamine green

This synthetic dye has similar staining characteristics to rose bengal but is far less irritating to patients, and at concentrations of 0.5 to 1 per cent, far less likely to cause toxicity. Lissamine green does not stain healthy cells as does rose bengal.

MULTIPLE-CHOICE QUESTIONS – take part at opticianonline.net

1 How might the view of lissamine green staining be best enhanced?
A Cobalt blue light
B Yellow Wratten filter
C Red-free light
D Red Wratten filter

2 What is an adequate volume of lissamine green to instil in the fornix?
A 5µl
B 10 to 20µl
C 20 to 30µl
D There is no ideal amount

3 Where might the first appearance of staining most likely occur in dry eye?
A Superior bulbar conjunctiva
B Nasal interpalpebral bulbar conjunctiva
C Temporal interpalpebral bulbar conjunctiva
D Inferior bulbar conjunctiva

4 Which of the following statements about corneal staining is true?
A Rose bengal does not stain the cornea
B Lissamine green does not stain the cornea
C Rose bengal staining of the cornea is more noticeable in Afro-Caribbeans
D Sjögren’s syndrome may result in lissamine green staining of the cornea

5 Which of the following is true regarding staining of the lid?
A Lid margin is best assessed with fluorescein
B Fluorescein staining is isolated to the margin
C Lissamine green does not stain the tarsal plate
D Marx’s line is best visualised with fluorescein stain

6 Which of the following statements about rose bengal is true?
A It only stains dead cells
B It stings more than fluorescein but less than lissamine green
C It may cause persistent unsightly staining of the face
D Its toxicity is unaffected by ambient light

Successful participation in this module counts as one credit towards the GOC CET scheme administered by Vantage and one towards the Association of Optometrists Ireland’s scheme. The deadline for responses is March 5 2010.