Diagnosis of the Dry Eye

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Introduction

The causes of keratoconjunctivitis sicca (KCS) are manifold. Cicatricial, nutritional, neurogenic – both acquired and congenital – and exposure factors can be present alone or in any given combination. In this study, the evaluation of the clinical tests in keratoconjunctivitis sicca is limited to those forms of KCS that are caused by a decrease in the tear gland function, be it as a result of autoimmune inflammatory reactions or as a result of involution.

As in every day clinical practice the Schirmer I, the Rose bengal and the break-up time tests are by far the most commonly used, these tests will be reviewed in more detail. The lysozyme and the lactoferrin tests will be only very briefly assessed as they are actually laboratory tests, although in those clinics interested in dry eye problems, these tests are used as routine clinical procedures.

The Schirmer Test

In 1903 Schirmer [1] developed a clinical test to measure the amount of tear fluid produced in a certain time period. The interpretation of the test has been controversial. Schirmer believed that if wetting of the filter-paper strip was below 15 mm, keratoconjunctivitis sicca should be suspected. It is true that in early KCS – as judged by the concentration of tear proteins such as lysozyme and lactoferrin – values of 15 mm or more in wetting of the filter-paper strip can be observed, but taking this limit for the diagnosis of KCS would imply that 51% of the normal population – judged by the concentration of tear proteins in the tear fluid – suffer from KCS.

Beetham [2], on the basis of his clinical experience, felt that wetting of less then 10 mm of the filter-paper strip was indicative for KCS. Again, in early KCS, as judged by the concentration of tear proteins in the tear fluid, values of 10 mm or more in wetting of the filter-paper strip can be observed, but taking this limit for the diagnosis of KCS implies that 35% of the normal population – judged by the concentration of the tear proteins in the tear fluid – have dry eyes.

These limits between normality and disease were based on taking the
average minimal values of wetting of the filter-paper strip that were observed in persons without any functional symptoms. These are not meaningful limits and consequently divers and radical opinions on the merits of the Schirmer test were common. This neglect to set useful limits between normality and disease resulted also in a tendency to devise new tests based on the same principle that were supposed to be more accurate.

The correct way to set limits between normality and disease is to study the frequency distribution of Schirmer values in patients in whom there is no doubt that they are suffering from KCS on one hand, and those of a control population on the other hand [3]. By doing so, a considerable overlap of these distributions is apparent, indicating the weakness of the Schirmer test as a diagnostic test. In a test with high discriminatory power, the distribution of the studied parameter of the population with KCS and that of a control group have little overlap.

If the probability of misclassification for the Schirmer I test is balanced, that is to say choosing that limit of the Schirmer value in patients with KCS and control persons, at which an equal number of patients are wrongly diagnosed as being normal and vice-versa, then the optimal limit is 5.5 mm wetting of the filter-paper strip in 5 minutes. With this limit the probability of misclassification is 16%; this means that 1 in every 6 patients is misclassified as normal and 1 in every 6 normal persons is considered to have KCS. This shows the Schirmer test to be not particularly good for the diagnosis of KCS. It is important to realise that this value of the Schirmer test, i.e. 5.5 mm wetting of the filter-paper strip to diagnose keratoconjunctivitis sicca does not represent a limit that patients with the dry eye state cannot exceed. The average of the Schirmer values in early cases of keratoconjunctivitis sicca will most certainly exceed the diagnostic limit of 5.5 mm wetting of the filter-paper strip, but these values cannot be used to diagnose the dry eye state with any certainty.

The Jones Test

Jones [4] separated tear secretion in reflex and basic secretion. Reflex secretion in his theory would be a function of the main lacrimal gland, while basic secretion would be a function of the accessory lacrimal glands of Wolfring and Krause. According to Jones, the Schirmer I test measures the reflex secretion as the filter-paper strip stimulates the trigeminal nerve. However, if the same test is performed after local anaesthesia the afferent stimulus originating from the conjunctiva is suppressed and the resultant wetting of the filter-paper strip would represent the “basic” secretion and would reflect the physiologic tear flow.

This concept of Jones has created considerable interest, especially because the idea emerged that studying the physiologic tear flow would most likely yield a new, relatively simple test to perform, or so it was hoped at least. Norn [5], however, pointed out that the lid margin with its cilia is more sensitive