

ROSE BENCAL:
ITS CLINICAL USE

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Rose Bengal has been used and advocated as a useful clinical stain for many years. It is a vital stain and as such, is used for detection of various corneal abnormalities that our routine use of Flourescein does not reveal. The purpose of this paper is to, 1) explore the staining properties of Rose Bengal as it relates to Flourescein, 2) discuss various clinical uses and types of patients we can expect to see staining in, and 3) summarize how we as clinicians can utilize Rose Bengal to help us better manage patients in our daily practice.

Rose Bengal, dichlororotetraiodo flourescein sodium, is a derivative of, and chemically related to sodium flourescein. It has been demonstrated, however, that these two stains have significantly different staining properties. Rose Bengal is a vital stain and is particularly useful in staining degenerated, dying, or dead tissues, including corneal epithelium, conjunctival tissue, and mucous strands, under the proper conditions.¹

Much controversy has arisen concerning this last statement. Many people have asked why a dying or degenerated cell is different in its staining properties than a live viable cell when it comes to using Rose Bengal. The answer to this question is quite important, but to answer it more fully we need to compare the two stains we routinely use in practice.

Flourescein has routinely been used to stain when some corneal defect is suspected, but what kind of defect does it really reveal? Classically, it stains punctate epithelial erosions and abrasions. In other words, epithelial defects. These are usually defined as being quite fine, depressed lesions in

¹Zuccaro, Vincent S., O.D. Rose Bengal: A Vital Stain. Contact Lens Forum. October 1981; pg. 39.

the cornea, though they obviously can range in size considerably. These are areas in which there has been a loss of normal surface epithelium with exposure of underlying immature cells. With this type of lesion the Flourescein filters through the broken epithelial surfaces and diffuses among the epithelial cells without actually staining the cells themselves. It simply fills intercellular spaces. The stain can then spread deeper and as we sometimes see with severe recurrent erosions and deep corneal abrasions, may even reach deeper layers of the cornea and the aqueous humor.²

Rose Bengal, on the other hand, stains the cells and the cells' constituents. In the very early stages of cell degeneration, the cell wall, the cells only real protection, begins to break down and becomes more permeable to extracellular substances. If Rose Bengal is present it will be allowed into the cell and will stain the cell wall, cytoplasm, and especially the nuclei quite intensely. Unlike Flourescein it will not penetrate into intercellular spaces or aqueous. There are many corneal abnormalities in which we should see Rose Bengal staining taking place. These will be discussed later but it must be said that the majority of these disease processes fall into the category of inflammatory keratopathies and not simple corneal erosions or abrasions.

From the above discussion it would seem that each stain is quite specific and for any one patient, we would expect to see only one type of staining taking place. In many, but not all cases, this is true. If the corneal lesion has a smooth base and intact deeper epithellum, chances are very good that you will only see Flourescein staining. Staining multiple contact lens patients and primary care patients showed us that small epithelial defects can indeed exist giving us Flourescein staining with

²Norn, M.S., M.D. Vital Staining of the Cornea and Conjunctiva. The Contact Lens. Volume 3, January 1972, Denmark; pg. 19.

absolutely no signs of Rose Bengal staining. The opposite can also be true. Rose Bengal staining can also be abundant with little or no Flourescein staining accompanying it. This situation can be much more difficult to detect clinically. It occurs in such diseases as Keratoconjunctivitis Sicca or dry eye syndrome, viral diseases such as Herpes Simplex and Herpes Zoster, Staphylococcus Blepharokeratoconjunctivitis, some chlamydial diseases, chemical keratitis, and even some severe exposure keratitis cases. The difficult part of detecting Rose Bengal staining by itself often lies in the disease process itself.

We as optometrists do not see the disease process in its beginning stages. We see them as a result of physical symptoms or complaints the patient has later on. If we could see them in the first or second day when cells are just beginning to be compromised, we would find Rose Bengal staining alone. We most often see them considerably later than this and as a result epithelial damage, death, and accompanying epithelial erosion and sloughing has occurred. At this point, the epithelial defect is much larger by comparison than the area of dying cells so the area of Flourescein staining is much more significant to us. It is also possible that by the time we see this patient the inflammation has run its course and all that remains is the defect itself.

To confuse matters even more, many "epithelial defects" have been found to stain with Rose Bengal and Flourescein when Flourescein was expected to stain this tissue alone. This would seem to contradict my previous discussion, however, if we assume that with any corneal abrasion there are both cells that have been sloughed away and cells that are damaged and dying but still present, this is much easier to understand. As we know, an abrasion

will stain centrally with Flourescein. We will occasionally, however, find that the edges of the abrasion and some very small punctate areas within the lesion will also stain with Rose Bengal. These stained areas are cells that have been damaged and have not been swept away by the injuring force or the lid and tear action of the eye. An example of this occurring would be during repeated applanation tonometry using the Goldman device. While I did not see any Rose Bengal staining with daily routine use of this instrument, it has been reported that with multiple measurements or with Shiotz tonometry being performed, Rose Bengal staining may be observed.³

It has also been noted in certain inflammatory diseases that both types of staining have been observed. An example of this is in Dendritic Keratitis or Herpes. Flourescein will stain the dendrite and surrounding area by filtration diffusion while Rose Bengal will stain the dendrite processes only. Both can be quite helpful in your diagnosis.⁴

Rose Bengal and Flourescein can also be used together in one more significant way. Contact lenses are a very large part of most optometric practices and as clinicians we are constantly looking for ways to make the patient as comfortable as possible with their lenses. Flourescein has been the long term stand-by for this task. It has been suggested that combined use of Rose Bengal and Flourescein can aid us here also.

³Norn, M.S., M.D. Specific Double Staining of the Cornea and Conjunctiva with Rose Bengal and Alcian Blue. Acta Ophthalmologica, Volume 42, 1964; pg. 87.

⁴Norn, M.S., M.D. Vital Staining of the Cornea and Conjunctiva. American Journal of Ophthalmology, Volume 64 #6, December 1964; pg. 1078.

Again, Flourescein will identify epithelial lesions and disruptions but Rose Bengal reveals areas on the cornea that are being insulted mechanically by the contact lens, causing actual disruptions of cell walls and cell death. Rose Bengal then can point us to where lens modification may be indicated to increase the patient's comfort.

Many of the things I have just discussed were very difficult to see and substantiate in a clinical setting for a number of reasons. To see Rose Bengal staining on a regular basis the patient population has to contain a large number of patients suffering from the disease mentioned earlier. My particular patient population did not contain these people in a high percentage so consequently, after staining approximately 50 patients the amount of patients with Rose Bengal staining was quite low. I did see three patients that were diagnosed as having Keratoconjunctivitis Sicca and all three demonstrated diffuse corneal punctate staining with both Flourescein and Rose Bengal.

Population factors are one possible explanation for the low percentage of corneal staining that was seen. I feel that there is another possibility to be considered. Most of the previous work done with Rose Bengal was performed using 1% and 10% solutions of Rose Bengal. These high concentrations were very effective at staining even the most subtle corneal abnormalities. According to M.S. Norn, M.D. these concentrations are very effective, with the 10% solution staining very mildly degenerated cells, and the 1% solution staining severely damaged and dead cells. There was one major drawback to these solutions, however, upon installation they were very irritating to the eye and in some cases were found to cause corneal staining themselves.

As a result of this, in 1980, Barnes-Hind Pharmaceutical Inc., released Rose Bengal Ophthalmic strips for diagnostic use. This is what we now have available to us for clinical use and what was used for my research. Each strip contains a carefully controlled amount of Rose Bengal, 1.3 mg. While this method is very easy to work with and has almost 100% patient comfort, I believe we have sacrificed our ability to stain and detect early corneal problems because of a lower concentration. Obviously, the actual concentration that is delivered to the eye depends on the amount of Rose Bengal dissolved in the wetting solution and the size of the drop put into the eye, which was not controlled in this investigation. I had no way to determine the actual concentration delivered with each installation and for our use I do not feel that it is important. What we must remember is that if the concentration is low, then we must not dismiss patients with symptoms of corneal problems even though it may not have stained at that particular time.

There is one major drawback we must talk about with Rose Bengal. It is unfortunate that Rose Bengal also stains mucous in the normal healthy eye. This fact makes it very difficult to differentiate between patients with pathological dying cells and a normal eye. This particular problem can be overcome. While it was not attempted in my research, a counterstain must be used which is specific for mucous. Alcian blue is a stain that can be used. When stained with Alcian blue, any area that stains blue is mucous, those that remain red are pathological cells and must be more carefully examined.

How can we as clinicians utilize Rose Bengal Ophthalmic strips to help us in total patient care? As can be seen from this paper, it can be a very

good diagnostic tool when used in conjunction with other stains, especially Flourescein. There are, however, a number of things we must remember to do when we use these strips.

Like Flourescein strips, Rose Bengal strips must be well moistened with a stream of irrigating solution (e.g. Blinx). Wetting solution should not be used because they can reduce the activity of both of these stains, and consequently, cause findings to be unreliable. Rose Bengal is then applied to the eye like Flourescein. Examination with the Biomicroscope and a bright white light illumination gives the best results. Any tissues that have been damaged or are dying will stain a vibrant red/purple usually in the appearance of red punctate dots. Obviously, dendritic ulcers, etc., will stain in their normal shaped appearances.⁵

The normal healthy eye will also show some Rose Bengal staining which can be observed in varying amounts on different people. The majority of patients will show a fine punctate line of staining on the inferior tarsal conjunctiva along the ciliary margin which may continue into the punctum lacrimal. This same pattern may also be seen on the superior tarsal conjunctiva. It was also observed in my study that the plica simlunaris and caruncle also stain quite brilliantly with Rose Bengal.

What patients should we then consider using Rose Bengal stain on? It can be used like Flourescein as a part of routine slit lamp exams because of the new easy to administer ophthalmic strips. However, there are also the "at risk" patients as in any diagnostic test, that we need to be concerned with. Rose Bengal should be used with any patient with dry eye type complaints whether it is due to tear deficiency or a fast breakup time.

⁵Zuccaro, Vincent S., O.D. Rose Bengal: A Vital Stain. Contact Lens Forum. October 1981; pgs. 42 and 43.

It should be used with Keratoconjunctivitis Sicca patients with particular attention during your slit lamp examination to the cornea and para-limbal bulbar conjunctiva, especially at the three and nine o'clock positions, which also characteristically stain in these patients. It should be used with routine contact lens patients if Flourescein staining is present and you suspect a poorly fitting hard lens. It should be used with any corneal abrasion, injury, or infection to evaluate the disease process that is occurring. Finally, it should be used with all elderly, aphakic, keratoconic or corneal grafted patient to map the progress of these patients.

Rose Bengal is a very useful diagnostic tool for the practicing optometrist. Like any other single test, it does not give all the information that we need for total care, but with combined use of Rose Bengal and Flourescein on a routine basis, we will be able to render better care and perhaps answer more questions about corneal integrity that have been mysterious to us in the past.