

TECHNICAL NOTE

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A New Film for Ultraviolet Photography

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ABSTRACT: A new generation of black-and-white films manufactured by Eastman Kodak under the name of T-Max have proved, through controlled experiments, to be superior to existing film emulsions in recording short ultraviolet reflective and fluorescent photographs. The positive and negative aspects of this film emulsion are explored as they apply to forensic ultraviolet photography.

KEYWORDS: forensic science, ultraviolet photography, photographic emulsions

The latest family of film emulsions recently introduced by the Eastman Kodak Company offers advantages to forensic scientists over conventional black-and-white film emulsions. T-Max, meaning "tabular," makes use of manipulated light-sensitive silver halide crystals to produce a flatter grain surface as opposed to the "pebble-shaped" silver halide crystal used in other conventional photographic film emulsions (Fig. 1). By flattening the grain, more surface is available for light exposure and smaller-sized grains can be used without a loss in light sensitivity.

The smaller grain size also allows for a finer grain pattern in the film resulting in greater resolution and acuteness in photographic images of the subject. The "tabular" or "T" grain emulsion has a greater tolerance for accidental or deliberate over- or under-exposure when compared to conventional film latitude. For example, a one-f-stop over or under-exposure does not require any special film development to produce a usable image. The experiments that we made in comparison to Kodak's Tri-X film were deliberately overexposed and the resulting negative images on T-Max had both a normal exposure appearance and printing characteristics (Fig. 2).

While Kodak technical handouts state Tri-X and T-Max should not be compared, the comparison is inevitable since both films have a similar sensitivity to light. In our comparisons, we found under controlled studio conditions that T-Max 400 produced a higher resolution image and greater contrast between highlights and shadows, while at the same time

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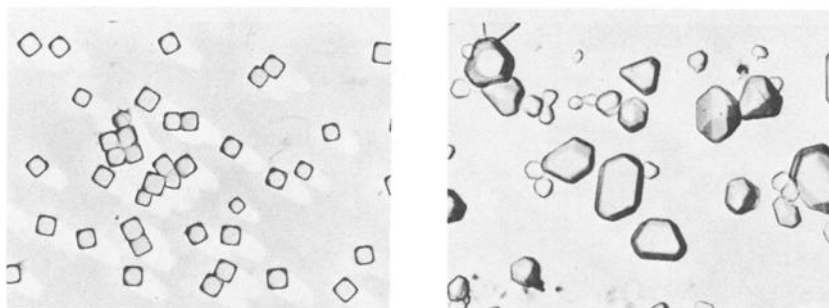


FIG. 1—Conventional silver halide grain structure (right) is compared to the new “Tabular” or “T grain” (left) which is used in the manufacture of Kodak’s T-Max black-and-white film emulsions. The flatter surface of the “T” grain produces greater light sensitivity with less granularity than the conventional grain structure. (Illustration courtesy of Eastman Kodak Company).

producing a negative image which printed with one-f-stop less exposure than an exactly exposed Kodak Tri-X negative. This comparison remained the same when using the film for both conventional black-and-white photography and with a filter to produce reflective ultraviolet photographic images (Fig. 3).

For our experiment we selected an old hypopigmented knee scar for our subject and a month-old thigh bruise. Identical exposures were made on Kodak Tri-X film rated at EI 1600 and Kodak T-Max 400 rated at EI 1600. For the reflective ultraviolet photographs, a Kodak 18A ultraviolet barrier filter was placed in front of the camera’s lens. The Tri-X film was developed as recommended for the 1600 Exposure Index in Acufine developer, and the T-Max was developed as recommended for EI 1600 in T-Max developer (10 min at 68°). The normal black-and-white images were printed to produce normal contrast for the T-Max image, and the exposure was adjusted to produce the same tonality between the two different film types.

The reflective ultraviolet photographs were printed for enhanced contrast by using a contrast grade five paper for both the Tri-X and T-Max 400 image. While the reflective ultraviolet negatives were made using a variety of camera f-stops between f-2.8 and f-16, the negatives exposed at f-4 were selected because of their visual appearance and photographic prints made in a manner to produce near identical tonal appearances for comparisons.

When the prints and negatives were compared, we came to the following conclusions.

- T-Max 400 has enhanced separation between highlight and shadow densities producing a somewhat greater contrast in the image.
- T-Max 400 has a finer grain structure than the comparably rated Tri-X film while retaining the sensitivity to light.
- T-Max 400 produces a better photographic image when deliberately overexposed than does Tri-X film.
- T-Max appears to have a greater acuteness and resolution of the image than does Tri-X film.
- T-Max appears to have a slightly greater sensitivity to red light waves than does Tri-X film in that red skin discoloration recorded in greater density on T-Max than on Tri-X film emulsion.

It is our opinion that Kodak T-Max film offers many advantages over conventional comparable black-and-white films with one exception. The only drawback encountered dealt not with the T-Max film, but with the recommended T-Max developer. Kodak recommends a special T-Max developer be used for best results. This film developer is convenient to use

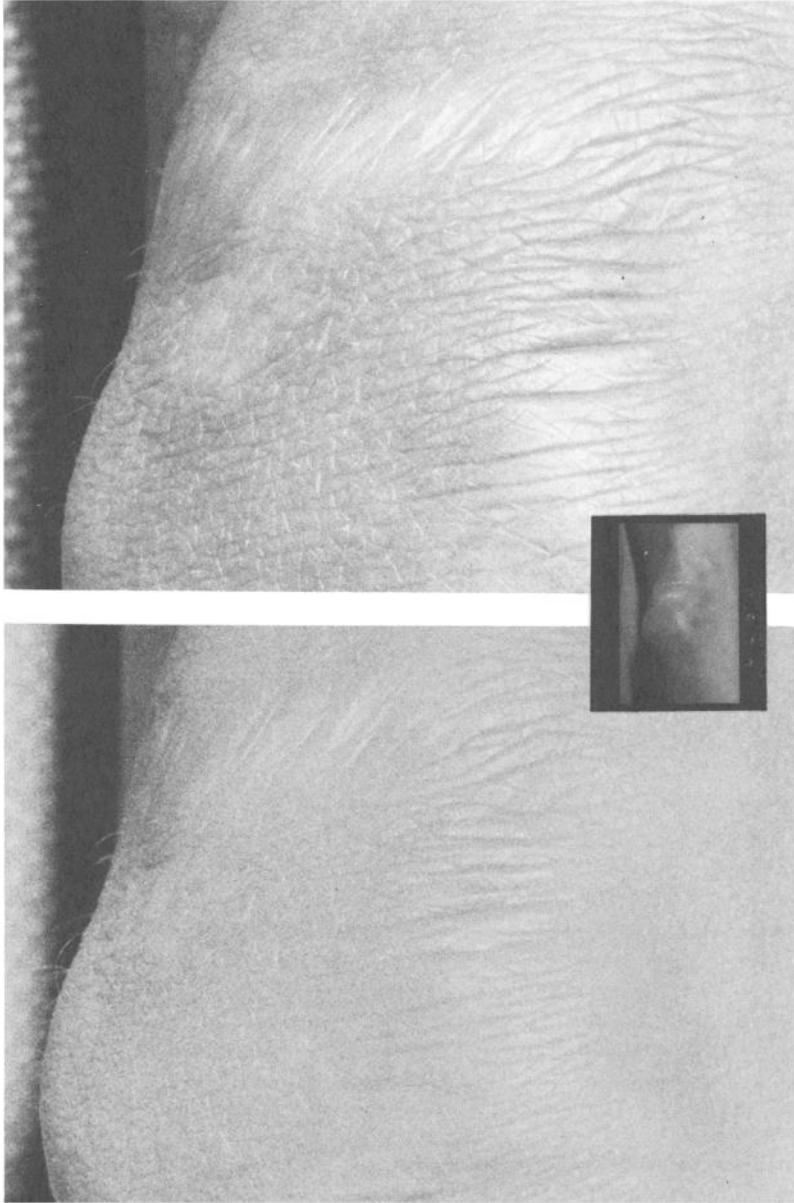


FIG. 2.—Photographic prints of a hypopigmented scar compare Kodak Tri-X (left) and Kodak T-Max 400 (right). Both negatives were overexposed by one f-stop to demonstrate the improved latitude and granularity of the T-Max emulsion. Original image size is illustrated in the 35-mm contact print located center. (Photographs by authors).

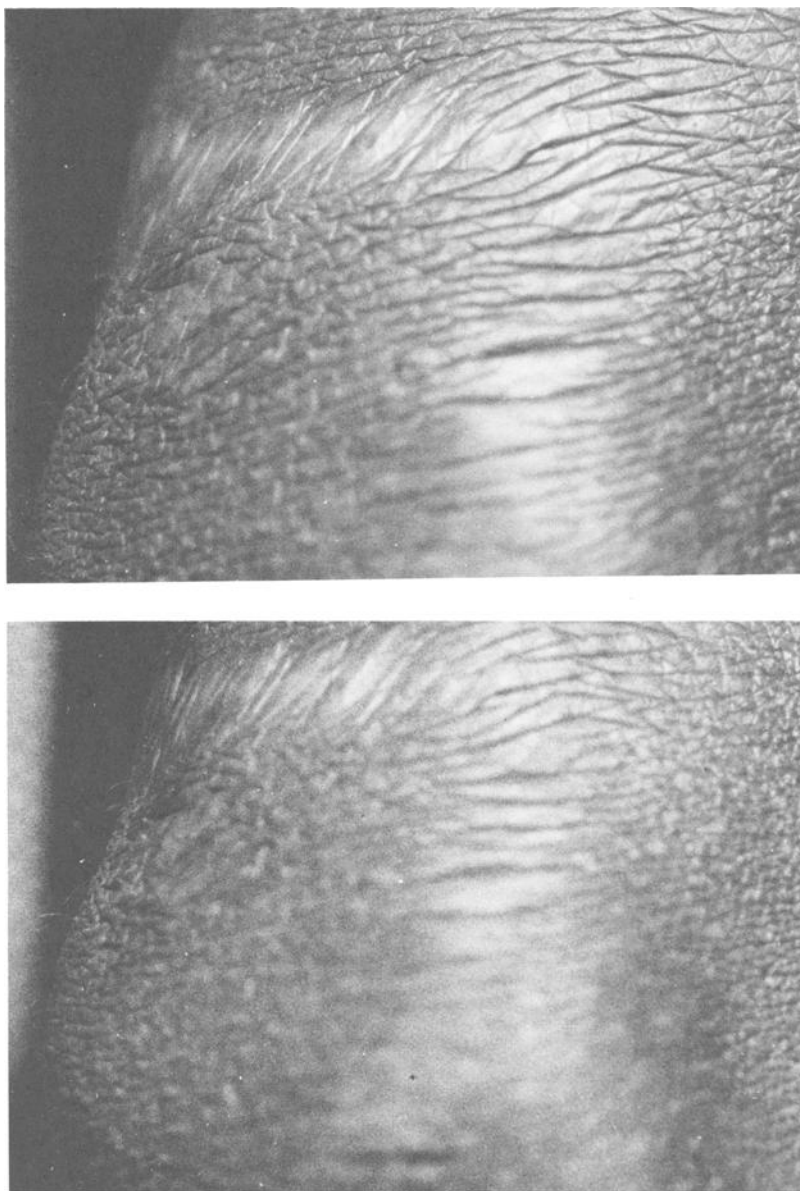


FIG. 3—Reflective ultraviolet photographs compare the contrast and granularity of Kodak Tri-X (left) and Kodak T-Max 400 (right) of a hypopigmented scar. Both films were rated at an Exposure Index of 1600. The T-Max 400 film produced a sharper, more detailed reproduction of the scar. (Photographs by the authors).

since it comes as a liquid concentrate and can be easily diluted to a four-to-one working strength. T-Max developer, however, does not have a companion replenisher solution which necessitates either an increase in developing time depending on the number of rolls of film that are processed through the diluted developer or the use of the diluted developer for a single time and then discarding it. While this may not be a consideration for the occasional user, and may even be an advantage for some in having fresh developer for each roll of film, it can be a financial disadvantage for high volume users who will be using a larger amount of developing supplies because of the "one-shot" nature of the developing process.

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