

A TECHNIQUE TO ENHANCE THE RESOLUTION-PROPERTIES OF ANALYSES USING FUJI PRESACLE PRESSURE-SENSITIVE FILM: A.B. Liggins and J.B. Finlay. University of Western Ontario, University Hospital, P.O. Box 5339, London, Ontario, Canada, N6A 5A5.

PURPOSE: To investigate a practical method for increasing the pressure- and spatial-resolutions possible with Fuji film, using digital analysis methods.

METHOD, RESULTS AND DISCUSSION: Investigations of both intact and prosthetic joint interfaces may involve small contact-areas or regions containing high pressure-gradients. Fuji film is commonly used in these studies; however, the spatial- and pressure-resolutions of this material are limited by the granularity of the stains it produces. The objective of this work was to investigate the efficacy of using an image-averaging technique for enhancing the resolution-properties of Fuji film.

25-mm-diameter calibration-stains were produced from "super-low" grade Fuji film, for twelve uniform pressures between 0.25 and 3 MPa; these stains were digitized, using a PC-based digitizing system and the resulting data used to produce a fifth-order calibration-curve. A further six "test" calibration-stains were produced at each of four nominal pressures (0.5, 1.0, 1.77 and 2.5 MPa); these stains were also digitized and the resulting stains used in the following protocol.

A custom-written computer program was used to add the values of corresponding pixels on two to five (randomly-selected) stain-images; an average value was then calculated for each pixel, to provide the data for a "resultant" stain-image. This procedure was conducted six times for each nominal value of applied pressure. The resultant stain-images were analyzed to provide overall values of mean pixel-value (M_o) and (pooled) standard deviation (S_p), for the population of six images for each number of combined stains at each nominal pressure. Valid pressure-ranges for each population of stains were determined from the fifth-order calibration curve, using $M_o \pm S_p$; these ranges were then used to determine the pressure-resolutions for each number of combined stain-images.

The results showed that this "image-averaging" technique increases spatial-resolution, such that one additional pressure-band (represented by a single colour) can be identified on subsequent false-colour pressure-maps for each additional stain used in the resultant stain-image.

CONCLUSION: Averaging data from several Fuji film stains, taken from the same interface, increases pressure-resolution for a given spatial-resolution, by reducing the effects of stain-granularity.

SIGNIFICANCE: This technique allows pressure-maps to be produced from smaller contact-areas and regions of higher pressure-gradients, than was previously possible.