



E121 Alternate Light Wavelength and Filter Detection of Inflicted Cutaneous Bruises

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Learning Overview: After attending this presentation, attendees will understand which alternate light wavelengths and filters are most likely to be effective in the detection of potential bruises.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by potentially improving the likelihood of cutaneous bruise detection during the clinical assessment of victims of violence.

Forensic clinicians often struggle with identifying and documenting bruises on victims of physical violence, particularly on those with older injuries or darker skin. The Department of Justice has recommended the use of alternate light as a tool to enhance visualization.¹ However, rigorous scientific evidence is lacking to broadly support the adoption of this technology for this purpose. It is also unclear how bruise age may impact the specific wavelength performance. The aim of this randomized controlled trial was to determine whether certain wavelengths of alternate light with the ultraviolet and visible spectrums are effective at improving detection of likely bruises over time.

A sample of 157 healthy adults received a bruise inflicted to the lateral deltoid using the controlled application of a paintball pellet. Quota sampling was used to ensure equal representation of six skin color categories determined by spectrophotometer. Bruises were assessed at 21 timepoints over four weeks. The order of assessment in this crossover study was randomized with assignment to alternate light (treatment) and white light (control). Alternate light bandwidths evaluated included 365nm, 415nm, 450nm, 475nm, 495nm, 515nm, and 535nm with observations made using yellow, orange, and red long-pass filters. Multilevel modeling was used to account for the correlated data structure. The multilevel structure entailed wavelength measurements nested within assessments for each subject. Marginal models were used with fixed effects to control for the following variables: skin color, gender, arm fat, age, bruise age, and observer.

The retention rate of this longitudinal study was high (95%). The sample was primarily young ($M=24$, $SD=7.6$ years) and dominantly female (73%), with an average Body Mass Index (BMI) of 26 ($SD=6.7$). A total of 2,903 bruise assessments were completed resulting in more frequent bruise detection under alternate light (98.6%) compared to white light (85.7%). The odds of detection were greatest compared to white light for 415nm and 450nm using a yellow filter (OR=5.3, 95% CI: 4.3–6.5, $p < .0001$; OR=4.1, 95% CI: 3.3–4.9, $p < .0001$, respectively), followed by the orange filter under the same wavelengths. All of the remaining bandwidths had significantly lower odds of bruise detection compared to white light. Based on these results, recommendations can be made for clinical forensic units to invest in alternate light technology to improve the detection of potential bruises.

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Reference(s):

1. U.S. Department of Justice. *A national protocol for sexual assault medical forensic examinations: Adults/adolescents*. 2nd ed. Washington, D.C.: U.S. Department of Justice, Office on Violence Against Women; 2013.

Bruise, Alternate Light, Detection