E23 Predicting Alternate Light Absorption in Areas of Trauma Based on Skin Color: Not All Wavelengths Are Equal

Katherine N. Scafide, PhD, George Mason University, Fairfax, VA 22030; Nancy R. Downing, PhD*, Texas A&M College of Nursing, Bryan, TX 77803; Matthew J. Hayat, PhD, Georgia State University, Atlanta, GA 30303; Daniel J. Sheridan, PhD, Johns Hopkins University School of Nursing, Baltimore, MD 21205; Nesibe Kutahyalioglu, MS, George Mason University, Fairfax, VA 22030*

Learning Overview: After attending this presentation, attendees will be able to identify which alternate light wavelengths and filters increase the probability of detecting absorption in areas of physical trauma based on skin color.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by improving the likelihood of detecting evidence of physical trauma using an alternate light on diverse skin tones.

According to the National Crime Victimization Survey, less than half of all violent victimizations are reported to the police. Research does suggest victims of violence may be more likely to engage in the criminal justice process if their physical injuries are identified and documented. Unfortunately, individuals with dark skin tones are disadvantaged by current practices assessing soft tissue injuries by the naked eye. To overcome this challenge, a national protocol recommends the use of alternate light to improve the visibility of subtle injuries on adults and adolescents. However, there is limited research to show how skin color affects alternate light wavelengths in the detection of cutaneous light absorption originating from trauma.

The purpose of this study was to determine which wavelengths within the Narrow-Band Visible (NBV) and Ultraviolet (UV) spectrums improved detection of light absorption on areas of trauma over time. A randomized controlled trial was designed to prospectively bruise 157 healthy adults using controlled application of a paintball pellet to a randomly selected upper arm. Participant diversity was assured through quota sampling of six skin color categories determined using colorimetric skin color data collected from the lateral right deltoid. Using a cross-over design, the bruised area was examined 21 times over a four-week period using an Alternate Light Source (ALS) and white light in random order. The presence of light absorption was assessed using wavelength peaks within UV (365nm) and NBV (415nm, 450nm, 475nm, 495nm, 515nm, 535nm) spectrums and filters (yellow, orange, red). Multilevel models were used to account for the correlated repeated measures data collected in this study. The probability of detecting light absorption for individual wavelength/filter combination was calculated and estimates were made for each skin color category (area around the bruise).

Across each skin color category, the expected probability of detecting areas of absorption under alternate light wavelengths using 415nm and 450nm with a yellow filter were higher compared to white light or any other tested wavelength (e.g., dark skin: 415nm: 0.90, 95% CI: [0.87-0.93]; white light: 0.81, 95% CI: [0.77-0.85]). UV was limited in its effectiveness to individuals with light skin (e.g., very light skin: 0.93, 95% CI: [0.90-0.95]; dark skin: 0.20, [0.17-0.24]). ALS wavelengths of 415nm and 450nm provide a greater probability of detecting light absorption in areas of trauma across skin tones. With further development and evaluation of evidence-based practice guidelines, ALS is an ideal adjunctive tool to complement the physical assessment of injuries on diverse populations.

Alternate Light Source, Bruise, Skin Color

*Presenting Author