E76   Linking Footprints to Feet: Research Advances and a *Daubert* Case Study

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Learning Overview: After attending this presentation, attendees will learn the current scientific foundations and limitations of utilizing a footprint or footprints found at crime scenes to identify the criminal.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing insight and knowledge into the relatively new field of forensic podiatry, with a focus on footprint impression analysis.

Footprints recovered from crime scenes do not always display papillary ridge marks like those of fingerprints and, in these situations, footprint analysis involves measurement and comparison of the footprint's outline, shape, and consideration of other features.[1] The discriminatory and individualistic value of bare footprints is well-established, as are their use in linking (and unlinking) suspects to crime scenes. Research has found the odds of a chance match of a bare footprint to be one in 1.27 billion.[2] Numerous factors contribute to this individualistic nature of footprints, including a person's biomechanics, anatomy, weight, footwear, and particular habits or activities.

While bare footprint individuality has been proven, research on sock-clad footprints and foot impressions in insoles has been sparse. This research will present findings from a study published on the analysis of sock-clad footprints that established similar individuality to bare footprints. There will also be discussion on initial findings from a recently completed study on foot impressions in shoes.[3] The ability to establish the individuality of a footprint, whether bare, sock-clad, or inside footwear, has important consequences for forensic experts comparing suspects to such impressions.

Further, previously numerous methods of footprint measurement and comparison were proposed, some utilizing descriptive statistics to establish their validity. A method, tested with inferential statistics, was recently advanced by Reel et al. and has been found to be highly reliable across a combination of reliability tests.[4] This method, known as the "Reel Method," is now considered by some experts to be the gold standard for determining 2D linear footprint measurements for forensic comparison.

The state of the science of forensic footprint analysis will be reviewed with particular emphasis on meeting the *Daubert* standard, which was met in an analysis of a bloody sock-clad footprint found at a homicide scene. The case study of the *Daubert* challenge will be reviewed in the context of the latest scientific advances. Limitations remain in the analysis and comparison of footprint evidence and the presentation will highlight research that remains to be done as well as the aspects that can be relied on to link (or unlink) a footprint found at a crime scene to a suspect.

Reference(s):

1. Laskowski G.E., Kyle V.L. Barefoot impressions—A preliminary study of identification characteristics and population frequency of their morphological features. *J. Forensic Sci*. 1988;33:378–388.
2. Kennedy R.B. et al. A large-scale statistical analysis of barefoot impressions. *J Forensic Sci*. 2005;50:5. JFS2004277-10.
3. Nirenberg M.S., Ansert E., Krishan K., Kanchan T. Two-dimensional metric comparison between dynamic bare and sock-clad footprints for its forensic implications–A pilot study. *Sci Justice*. 2019;59(1):46-51.
4. Reel S., Rouse S., Vernon W., Doherty P. Reliability of a two-dimensional footprint measurement approach. *Sci Justice*. 2010;50(3):113-118.

Footprint, Footprint Analysis, Foot Impression

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