E12 Variation in Plantar Pressure Distribution Among Different Body Mass Index (BMI) Categories: Forensic Implications

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Learning Overview: After attending this presentation, attendees will comprehend the forensic application of correlating plantar pressure distribution with different BMI categories.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by contributing to the existing knowledge of forensic podiatrists in interpreting the body size of an individual from the plantar pressure distribution of static and dynamic footprints that may be recovered from the crime scene.

Bare footprints, either static or dynamic found as physical evidence at the crime scenes, can provide a connection between the crime and the perpetrator. The masking of the footprint is yet to become prevalent among the criminals; thus, some of them still go unshod while committing a crime. Unlike in India, Western countries where the culture of wearing shoes predominates, the presence of bare footprints is rare although there are instances in the West where there is a possibility of recovering footprints, as is commonly seen in cases of sexual assault or where the perpetrator's mistaken knowledge of footwear identification can lead him/her leaving bare footprint marks at the crime scene. The real value of a bare footprint is when it can be compared with suspects' footprints to establish individualization. Similar to fingerprints, bare footprints represent different levels of uniqueness and individuality depending upon numerous features. Morphologically, the footprint may be normal, flat, curved, or may have any intermediate shape depending on the weight of the body. It may be calculated by analyzing the footprint parameters such as footprint length and breadth, footprint contact area, footprint index, arch index, heel-ball index, etc. In addition, due to the highly associated nature of footprints with stature and body weight, it would not be wrong to state that a correlation between footprints and BMI may also exist.

However, limited forensic studies are available on approximately estimating BMI from static and dynamic plantar pressure distributions. Plantar pressure distribution may be exclusive to each individual and imparts knowledge about the structure as well as function of the foot. In the absence of any set standards, the identification of the criminal becomes difficult. This scientific gap has encouraged the present research work. The main objective of the investigation was to study the plantar pressure distribution with respect to BMI and body size. The study is based upon a random sample of 461 young adults (230 males, 231 females). The target group was identified. The students were instructed about the proper procedure prior to obtaining the footprints from both the feet while standing and walking using standard protocols. The footprints were taken from each participant using an inking method for comparison purposes. Upon examination, all the length measurements (T-1, T-2, T-3, T-4, and T-5) and footprint index showed statistically significant differences among all the three BMI group individuals, but width at ball, width at heel, arch index, heel-ball index, and footprint contact area did not show statistically significant differences. The footprint in terms of arch index indicated the presence of morphological differences between normal weight and obese individuals, with the obese category having a greater tendency toward lower arches or flat feet compared to normal and pre-obese individuals. It was inferred from the results that footprint morphology varied with different BMI categories. Overall, the study concludes that different BMI categories may be estimated by studying the footprint morphology of the plantar area of the foot when the foot makes contact with the ground during standing and walking. As a result, variations in the footprint was observed. However, while conducting this study, certain precautions were followed in the controlled conditions, which will be discussed in the presentation.

Forensic Podiatry, Plantar Pressure Distribution, Footprints

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