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Finger prints in sex determination

Rupa Devi R[1], Dr. Abirami Arthanari*[2]
[1]Department of Anatomy, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai – 600077, India
[2] Senior Lecturer, Department of Forensic Odontology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu- 600077, India
Email id: rupa2002raja@gmail.com, abiramia.sdc@saveetha.com

Abstract:
Sex determination is a crucial aspect of personal identification in forensic science and medico-legal investigations. Fingerprints, due to their uniqueness and permanence throughout an individual's lifetime, serve as an important biometric tool for human identification. The present study aimed to evaluate the role of fingerprint patterns in sex determination. A total of 50 fingerprint samples were collected from randomly selected individuals, including 25 males and 25 females. The left index finger prints of females and right index finger prints of males were obtained and analyzed. The fingerprints were classified according to the Edward Richard Henry classification system, which includes patterns such as arch, tented arch, left loop, right loop, and whorl. Statistical analysis was performed using SPSS software to determine the mean deviation and probability inference related to gender differences. The results revealed that 10% of females exhibited left loop patterns, 8% showed right loop patterns, 4% displayed whorl patterns, 2% had arch patterns, and 1% had plain arch patterns. Among males, 9% demonstrated whorl patterns, 8% showed right loop patterns, 5% exhibited tented arch patterns, 4% had left loop patterns, and 2% had plain arch patterns. The findings suggest that left loop fingerprint patterns are comparatively more predominant in females, whereas whorl patterns are more frequently observed in males. Although fingerprint analysis alone may not provide an infallible method for sex determination, it can serve as a valuable supplementary tool in forensic identification and forensic odontology. Further research with larger sample sizes and diverse populations is recommended to strengthen the reliability of fingerprint-based sex determination.

Keywords: Fingerprint patterns, Sex determination, Forensic odontology, Dactyloscopy, Ridge patterns, Personal identification, Loop pattern, Whorl pattern, Arch pattern, Forensic science.

INTRODUCTION

Sex determination is the method by which distinction between male and female is established in an organism under genetic control. The sex chromosome are for the determination of separate sex. Gender determination is an important aspect of personal identification, which is often required in medico legal practice1. Many experts believe that there are finer and more epidermal ridges on the fingers of women as compared with men. However, it is important to establish numerical cut off values in terms of ridge count to facilitate the sex determination within a particular population. Forensic DNA typing and subsequent molecular method of sex determination in humans hav proven to be an imperious tool to criminal just.2. To date, a number of methods exist for the capture of fingerprints from cadavers that can then be used in isolation as a primary method for the identification of the dead. We report the use of handheld, mobile wireless units used in conjunction with a personal digital assistant (PDA) device for the capture of fingerprints from the dead. We also consider a handled single digit fingerprint scanner that utilizes a USB laptop connection for the electronic capture of cadaveric fingerprints.3

Sex identification of suspect from crime scenes is an important task in forensic sciences that minimises search population of suspects. Existing methods for gender classification have limited use for crime scene investigation because they depend on the availability of teeth, bones or other identifiable body parts having physical features that allow gender and age estimation by conventional methods. Various methodologies have been used to identify the gender using different biometrics traits such as face, gait, iris, handshape, speech and fingerprint. Fingerprint has been used as an biometric for the gender and age estimation because of its unique nature and does not change throughout the life of an individual. 4

There are three ways to determine fingerprints age. The first determination is the physical appearance of the latent print, either before or after development. The second determination is the use of experiments that helps to establish the effect of environmental factors over a given period of time. 5The determination is the measurement of chemical changes in the constituents of latent print residueThe third method seems to hold the most promise in the quotes for the reliable, universally accepted method6. One of the problems determining fingerprints age is the fact that there are instances of relatively old latent prints developing in a manner previously thought unlikely. 7Latent prints are affected by many different factors. Subject factors include stress, metabolism , diet, health, age, sex, occupation and quantity and quality of finger contamination.

MATERIALS AND METHODS

Fingerprints sample were collected from random individuals . 25 male and 25 female samples were collected and packed in a envelopes individually without disclosing gender of fingerprints donor. Left index of female samples were collected and right index of male samples were collected. Then classification of fingerprints done based on the primary classification such as arch, tented arch, left loop, right loop and whorl. This classification was given by Edward Richard Henry and it is also called as 10 digit classification. The mean deviation was calculated using SPSS software to obtain the probability inferences of gender. The scientific study of fingerprint is called as dactyloscopy

Arch : The simplest and least common pattern may be classified as either “plain” when the ridges rise over the middle of the finger and “tented” when they rise to a point

Plain arch : In plain arch the ridges enter on one side of the impression and flow or tend to flow out the other side with a rise or wave in the centre.

Tented arch: Tented arches are similar to plain arches with the exception that the ridges in the centre form a definite angle; or on or more ridges at the center from an upthrust; or they approach the loop type of pattern; possessing two of the basic characteristics of the loop, but lacking the third

Ulnar loop: Ulnar loop are those type of pattern in which the loops flow in the direction of little fingers

Radial loop: Radial loop are those type of pattern in which the loops flows in the direction of the thumbs

Loop: Has a triradius which is the point that three ridges from different direction meet at 120 degree angles, a core which is a ridge surrounded by fields of of ridges that turn back 180 degrees on themselves, and may be radial where the loop opens toward the thumb or ulnar where the loop open towards the little finger.

Double whorl loop: The double whorl loop consists of two separate loop formations, with two separate and distinct sets of shoulders and two deltas.

Plain whorl: A plain has two deltas and atleast one ridge making a complete circuit, which may be spiral, oval, or any variant of the circle. An imaginary line drawn between two deltas must touch or cross atleast one of the recurving ridges within the pattern area.

Whorl: Has two triradii with the ridges creating different patterns inside

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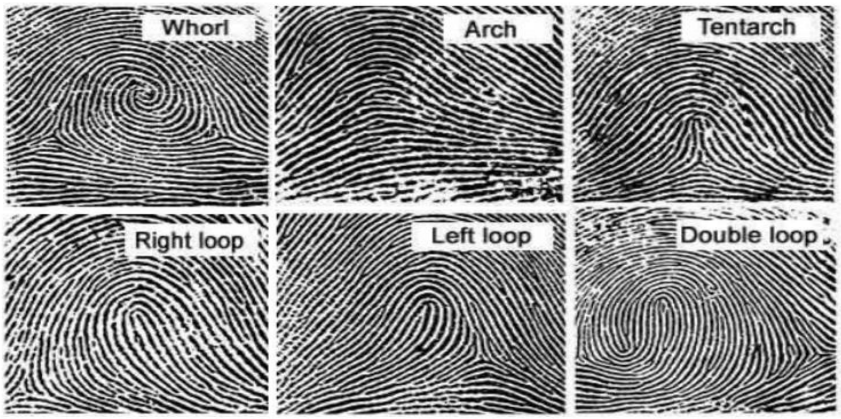
FIGURE 1:



RESULTS:

The study of fingerprint of 50 revealed the following observation:

10 percentage of female has left loop pattern, 4 percentage of female has whorl pattern, 8 percentage of female has right loop pattern, 2 percentage of female has arch, 1 percentage of female has plain arch, 9 percentage of male has whorl pattern, 4 percentage of male has left loop, 8 percentage of male has right loop pattern, 2 percentage of male has plain arch, amd 5 percentage of male has tented arch

FIGURE 2:

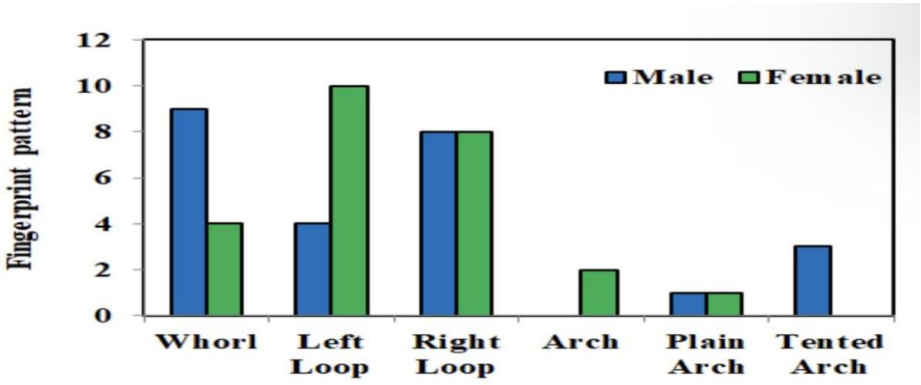


FIGURE 3: LEFT LOOP

FIGURE 4: RIGHT LOOP

FIGURE 5: PLAIN ARCH

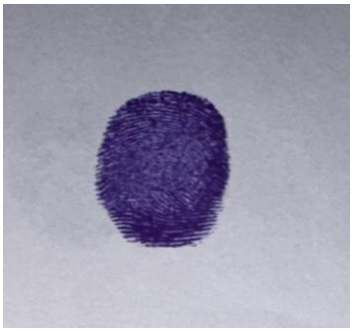


FIGURE 6: WHORL

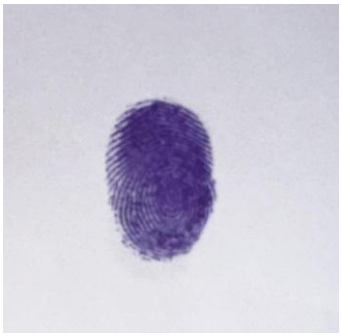


FIGURE 7: TENTED ARCH

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DISCUSSION

Many studies have been conducted on sex determination using fingerprints but, the present has been mainly conducted for race determination and genetic inheritance of fingerprints8. Fingerprints are commonly used tools to understand the individuality of a person so as to reveal his or her identity. Fingerprints are of universal nature which means all individuals carry this medium of identification. A criminal uses his hands in committing any crime and hence leaves mark on the scene of occurrence or any object, which comes in contact with his hands while committing the crime9. Hence, there are chances of occurrence of fingerprints in all crimes .

There are many criminals gloves while committing crime and in these situations no fingerprints can be identified10. Fingerprints are of permanent nature and they remain same throughout the life. No two people have exactly the same fingerprints. Even identical twins, with identical DNA, have different fingerprints11. This uniqueness allows fingerprints to be used in all sort of ways, mass disaster identification, and of course, in criminal situations.

Patent prints are collected using the standard manner of photography. The prints are photographed in high resolution using a forensic measurement scale12. The quality can also be further improved using low light or alternate light sources, chemicals, dyes etc. Latent prints are collected by dusting a smooth surface with the fingerprint powder, if prints emerge, they are then photograhed using a camera, lifted from the surface using an adhesive tape. The tape can then be kept on a latent lift card to preserve it13. The fingerprint is expressed through the interaction of genotype, development, and environment. The morphogenesis of the human hands and feet starts during the 6th week of the estimated gestational age14.The pattern of ridge skin is established from the 10th week to 14th week of EGA when the basal layer of the volar epidermis becomes folded and forms the primary ridges. This process is influenced by the volar pads, local eminence of subcutaneous tissue in well defined locations of the vocal surfaces15.Future studies can be done in different age groups and comparing both the gender as fingerprints can be used in gender determination. Sample size can be increased for more accurate results.

CONCLUSION

The present study is able to convey that left loop fingerprints is predominant in females and fingerprints are unique for an individual. Though the result obtained by the present study isn't convinced to be an infallible method nevertheless it does seem to go one step closer to the truth that fngerprint plays an important role in identifying sex as a supplementary tool alongside with other modes in forensic odontology. Research studies and knowledge regarding the use of fingerprints as evidence in personal identification and criminal investigation in forensic dentistry are considered scanty, but exists as a methodology in forensic dentistry. Studying in depth and establishing further facts and truth in fingerprints will certainly help as useful evidence in forensic dentistry.

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