A Preliminary Study on Assertion of Hand from Whorl Pattern on Thumb

Abstract

Fingerprints are the most important and crucial evidence found at the scene of occurrence which proves to give a positive means of identification. Due to uniqueness of fingerprints even identical twins can be differentiated where DNA profiling proves futile. The prints on crime scene are rarely found in sequence and often incomplete. As a result of which it takes too much time for a fingerprint expert to conclude regarding the origin of questioned fingerprint. Since there is lack of established parameters which could be helpful in ascertaining the hand from which a single fingerprint belongs, the job of an expert becomes more tedious and meticulous. Therefore present study attempts to decipher some characteristics features from 200 bilateral rolled thumb prints having whorl pattern which is the second most prevalent pattern (30-35%) found in whole population after loop pattern (60-65%). As a preliminary effort only thumb prints with whorl patterns have been considered which can be specifically extended to other fingers having loop, arch and composite patterns [1]. The future perspective of present study can be elaborated by undertaking population and genetic studies [2, 3].

Keywords: Fingerprints; Whorl patterns; Identification; Uniqueness; Crime scene

Introduction

Fingerprint is one of the most frequently found evidence at the scene of crime. They can be found in many crimes like murder, theft, dacoity, rape, burglary etc. It is essential evidence which is mainly used for personal identification and the most valuable evidence for identifying a suspect [4,5]. It can be significant evidence in identification of missing persons, amnesia victims, victims of mass disaster and insane persons etc. On the distal phalanges of the hand, some friction or papillary ridges are found on the epidermis called fingerprint [6, 7]. The elevated surfaces are known as papillary or friction ridges while the valley formed between two ridges are known as furrows or grooves. On the friction ridges many sweat pores are present which are connected to sweat gland present in the dermis. These sweat glands are connected to pore openings by the ducts. From these pore openings perspiration of sweat occur continuously. Fingerprints are used to grip any object. These are resist slippage of any object. Fingerprint has highly individualistic nature. Every individual has a unique fingerprint pattern on their fingers and it is known that, fingerprints differ individual to individual and also finger to finger. Even twins do not bear the same fingerprints. The study of fingerprints for the purpose of identification is known as Dactylography.

Methods and Materials

The present study has been carried out on 200 bilateral rolled thumb prints, which has been taken from 50 males and 50 females studying in different disciplines in Dr. Harisingh Gour University, Sagar, Madhya Pradesh, India. The age of the subjects ranges from 17 to 30 years and prints of unrelated subjects were taken. Thumb prints were taken as per the standard method stated by B.C.Bridges [8], where a subject is asked to stand in front and at a forearm length from the paper on which fingerprint has to be taken. A little of ink was taken on the pad which was rubbed against the glass plate in such a way that only a thin film of ink was uniformly distributed on the pad. The ink was uniformly distributed on the pad. The ink was then applied on the fingers from proximodistal direction. The print was then taken by placing the finger at right angle to the surface of the paper. The finger was then pressed lightly on the paper and rolled uniformly in radio-ulnar direction. Prints taken were further scanned so that the prints can be enlarged (2.6 X) for the study.

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Citation: Mandrah K, Kanwal NK. A Preliminary Study on Assertion of Hand from Whorl Pattern on Thumb. J Med toxicol clin forensic med. 2016, 1:2.
Thumb prints taken were analyzed for parameters like the slope of the apex ridges, central rotation of ridges, angle between the core and the delta, whorl tracing and the position of the perpendicular drawn between the core and the delta. These criteria's followed are in accordance to the study of Singh et al. (2005). Following criteria's were selected to ascertain hand from whorl pattern found on thumb (Figures A-E):-

**Result and Discussion**

Through the analysis of collected 200 bilateral rolled thumb prints taken for the analysis, following observations were made. Graph 1 & 2 shows the percentage of occurrence of fingerprint pattern in right thumb and left thumb respectively, it is evident from the Figure A that Ulnar loops are the most frequently found pattern in the thumb and the whorl patterns are found to be in majority after the Ulnar loops. Present study is focused on the analysis of whorl pattern for ascertaining the hand.

Earlier studies for ascertaining the hand was based on the analysis of each finger in respect of pattern found, Slope of the apex ridges, central rotation of ridges whether clockwise or anticlockwise [8], greater angle between core and delta, position of perpendicular bisecting two deltas and whorl tracing [9].

Present analysis shows that the slope of apex ridges has Ulnar inclination towards right or left side particularly in thumbs where the determination is 100%. This is very helpful character of the whorl pattern present in thumb for ascertaining the hand.

The clockwise rotation found in most left thumbs where the determination is 95.45% and anti clockwise rotation is mostly found in right thumb where the determination is 86.95% and circular ridges found least in whorl patterns whereas clockwise rotation found 94.54% in left hand and anti clockwise rotation found 81.50% in right hand.

The left side angle found to be more than right side in right thumb and vice versa. The percentage of greater angle found in right thumb is 69.59% in left side and in left thumb is 59.09% in right side whereas the percentage of greater angle found in right thumb is 80.80% which is in left side and 92.97% in left thumb where greater angle is in right side.

The position of perpendicular bisecting two deltas is towards left in right thumb and towards right in left thumb. The results are found 69.59% for right thumb and 54.54% for the left thumb whereas the position of perpendicular is found 88.43% in right thumb and 96.88% in left thumb. The tracing is outer type found mostly in right thumb and inner type found mostly in left thumbs. The percentage of outer tracing found 60.86% in right thumb and 72.72% inner tracing in left thumb whereas tracing is outer type found in 97.10% in right thumb and inner type found in 86.72% in left thumb [10, 11].

**Summary and Conclusion**

From the above study the following conclusions can be made:

1. Thumb prints are easily identified by their distinctive nature of superior size.
2. In maximum cases the apex ridges will have slope towards right side in right thumb and vice versa.
3. Central rotation of ridges in right hand thumb is anticlockwise in most cases and in left hand thumb it is clockwise.
4. In left hand thumb, the greater angle between core and delta is in right side and vice versa in most of the cases.
5. In left hand thumb, the position of the perpendicular bisecting two deltas is in right side and vice versa in most of the cases.
6. In right hand thumb, the whorl tracing is mostly of outer type and in left hand thumb it is inner type.

Therefore above findings found to be very useful for ascertaining the hand of a person from Whorl Pattern, although it is a preliminary attempt, this study has a very wide scope if extended to other patterns present on other fingers including population and genetic studies.
**FIG A: SLOPE OF APEX RIDGES**

Slope Of The Apex Ridges In thumbs or in any other finger, apex ridges are present on upper edge of the pattern area. These slanting apex ridges can have slope towards left or right. These positions of the slope can be useful to ascertain hand from single digit fingerprint. In thumbs Ulnar slopes are present. If the slope is found left to right, it means that it belongs to right thumb and vice-versa according to Bridges B.C [8].

**FIG C: ANGLE BETWEEN CORE AND DELTA**

Angle Between Core And Delta In whorl pattern, it is known that one core and two deltas are found. These three makes a triangle and the core is present in a specific position from each delta. These deltas make different angle from core. For the purpose of angle determination a perpendicular is drawn from core to the straight line joining the two deltas. This perpendicular intersects the angle at core which it makes with two deltas. On the basis of the intersected angles hand determination is done. In left hand’s print smaller intersected angle will be on the left side and vice-versa.

**FIG B: CENTRAL ROTATION OF RIDGES**

Central Rotation Of Ridges In whorl pattern central rotation of ridges can be either anticlockwise or clockwise. In right hand thumb the central rotation of the spiral ridges will be in anticlockwise direction and vice-versa according to Bridges B.C [8].

**FIG D: WHORL TRACING**

Whorl Tracing Whorl tracing is found to be very useful in ascertaining the hand from thumb print as it is seen that in right hand if whorl is present in thumb tracing is mostly of outer type and in left hand it is mostly of inner type.

**FIG E: POSITION OF PERPENDICULAR BISECTOR**

Perpendicular Bisector Drawn On The Line Joining Deltas The perpendicular bisector drawn on line joining the two deltas is very helpful in determining the hand. If the perpendicular bisector lies in between the core and left delta it indicates that the print is of right hand and vice-versa.
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