CHAPTER - 1

INTRODUCTION

One of the most important purposes of collection of physical evidence is to establish the identity of the suspect. The identification is possible through a variety of evidences. Finger prints are considered to be one of the best means for personal identification. The usual methods of identification lie in finding Pattern (First level) and Galton Details or ridge characteristics (Second level details) at their correlative positions in two finger prints. Any person can make an attempt to change his/her voice or handwriting but it is impossible to change finger prints because they are unique (even the finger prints of two fingers of the same person never match) and permanent. The palmer surfaces of the hands and the plantar surfaces of the feet (including distal phalanges) have ridged skin and are called papillary or friction ridge skin (Schroter, 1814). These ridges once they are formed in foetal life, except for growing in size remain unchanged throughout life and even after death or till the bodies decomposed. If the epidermis is injured it re-grows very quickly and, as long as the injury has not penetrated deep into the generating layer of the epidermis, the pattern of the ridges on the healed surface will be identical with the pattern as it existed prior to the injury.

Finger prints besides having application in criminal investigation, are also useful in the positive identification of deceased persons and disaster victims. In comparison to all other methods of identification, fingerprinting alone has proved to be both infallible and practical.

In 1914, Locard published his conclusions related to fingerprint identification and the criteria that should be used to assure reliability based upon the statistical analysis. His study showed the following tripartite rule that:

1. If more than 12 concurring points are present and the finger prints is sharp, the certainty of identity is beyond debate.
2. If 8 to 12 concurring points are involved, then the case is borderline and the certainty of identity will depend on:
   a. the sharpness of the finger prints;
   b. the rarity of its type;
c. the presence of the center of the figure (core) and the triangle (delta) in the exploitable part of the print;
d. the presence of pores (poroscopy);
e. The perfect and obvious identity regarding the width of the papillary ridges and valleys the direction of the lines, and the angular value of the bifurcations (Ridgeology[edgeoscopy]).

He also realized that

3. If a limited number of characteristic points are present, then the finger prints cannot provide certainty for identification but only a presumption proportional to the number of points available and their clarity.

These observations were generalized by Steinwender in 1958 regarding the value of 12-point threshold. But in many cases, the fingerprint impressions are partial, smudged, and fragmentary or imperfect due to certain reason i.e. the essential number of ridge characteristics are not available. It is a great handicap for the experts to give opinion on identity in such cases. Many criminals, who could have been brought to justice otherwise, enjoy the benefit of this handicapped.

In such of situations there is a need to include the third level details i.e. number, shape and relative position of sweat pores and shapes of the edges of the ridges. Locard (1912) studied pores (Poroscopy) that appear on the fingerprint ridges and their use in the individualization process. He also realized the value of the shape of edges of the ridges which are also permanent features like any other ridge characteristic and is called Edgeoscopy.

Edgeoscopy, which can be used as a method of personal identification, is the study of characteristics of the edges on the ridges; while Poroscopy is the comparison of the sweat pores. The edge characteristics on one side or both side of ridges, along with a few Galton details (Second Level details) or pores in their correlative positions are sufficient to prove the identity (Chatterjee, 1962).

Since very little work is available on the use of Edgeoscopy and Poroscopy in personal identification it was thought desirable to make a comprehensive study of partial, smudged or fragmentary finger prints and set standards for identification using the first, second and third level details.

The results obtained from the above study are expected to be helpful in identification particularly in those finger prints in which sufficient number of ridge characteristics or Galton’s detail are not available.
Finger Prints

Finger prints are the impressions made by the papillary ridges at the distal portion of fingers and thumbs. These ridges of the fingers are formed in 3-4th month of their foetal life and except for growing in size remain unchanged throughout life. Finger prints are impression produced by the roughly parallel raised lines separated by grooves, which come together to form a pattern in the central portion of the fingers. These raised lines provide friction to the fingers, so they are also known as friction ridges; these are unique to each finger of the individual. Such impressions when found at crime scene needs to be developed, lifted and are compared with like prints taken from suspects as specimen; they are the most valuable clues found at the crime scene. Prints are mostly conclusive evidence. An expert’s report may state three possible finding:

- The subject made the prints.
- The subject has not made the prints.
- The print had insufficient details to be evaluated.

The patterns formed by the ridges never change throughout a person's life. Criminals have often tried to change or destroy their finger prints, but they always grow back in exactly the same pattern or if the damage is so severe enough they are replaced by patches of scar tissue which themselves form identifiable patterns.

Type lines

The two innermost ridges which start parallel, diverge, and surround or tend to surround the pattern area, or when there is a definite break in a type line, the ridge immediately outside of it is considered as its continuation.

Based on the patterns formed by the friction ridges in the center of the finger prints, the patterns can be classified into four categories:

1) Arch
2) Loop
3) Whorl
4) Composite

1) **Arches:**

Arches are the rarest patterns found in the finger prints. In this pattern the ridge lines flow into the print from one side, rise in the middle of the pattern and flow out of the print from the other side. There are of two types:
(a) **Plain Arches:**
The patterns in which the ridges enter from one side of impression and flow or tend to flow towards the other side of the impression with slight elevation in the center like a small hill. There is no core, no delta.

(b) **Tented Arches:**
The pattern in which most of the ridges enter from one side of impression and flow towards the other side like plain arch, but in which the ridges at the center have an upward thrust in the shape of a tent arranging themselves on both sides of spine or axis towards which the adjoining ridges converge.

2) **Loops:**
The pattern in which one or more ridges enter from one side of impression, make a recurve and exit or tend to exit on the same side of the impression. In this pattern there is one delta and one core and Loops are of two types:-
(a) **Radial Loop:**
The loop pattern flowing towards the Radius bone i.e. towards the thumb of that hand is called Radial loop, which are rare types of pattern.

(b) **Ulnar Loop:**
The loop pattern flowing towards the ulnar bone i.e. towards the little finger of the hand is called ulnar loop and have one delta and one core.

(3) **Whorl:**
The pattern in which the ridges recurve in circular manner and at least one ridge makes a complete circuit around the point of core. The whorl pattern must have one core, two deltas and a recurving ridge in front
of each delta. To confirm the pattern as whorl, the line joining two deltas must touch or cross at least one of the recurving ridges in the pattern area. The whorls may be circular, spiral and oval in nature.

(4) **Composite Pattern:**
When two or more patterns (either of the same or different types) combine to form one pattern, that pattern is called Composite Pattern. The composites can be sub-divided into four types:

a) **Central Pocket Loop:** The pattern in which the majority of ridges from loops and one or more ridges recurve at the core to form a Pocket. Like Whorls, at least one ridge makes a complete circuit about the point of core and there are present two deltas, but unlike Whorls, the line joining two deltas must not touch or cross any recurving ridge in the pattern area.
b) **Lateral Pocket Loop:**
The pattern in which there are present two separate and distinct overlapping loops with separate shoulders and two deltas. The core forming ridges of the loops open towards the same side of the deltas. In other words, the core lines exits are not divided by deltas.

c) **Twin Loop:**
The Pattern in which there are present, two separate and distinct overlapping loops with separate shoulders and two deltas. The core forming ridges (core lines) of the loops open towards either sides of the deltas. In other words, the core lines exits are divided by deltas.
d) **Accidental Pattern:** The pattern which is too irregular to be classified in any of the previous patterns is termed as Accidental Pattern. This pattern consists of combination of two or more than two different types of patterns with two or more deltas.

The frequency of Loop pattern varies from 65-70%; Whorl and Composite 25-30% and Arch pattern is 5% (Chattopadhyay, 1975 and Bandhopadhyay and Dasharma, 1995). The pattern configurations are class characteristics, which give *first level detail*. Overall ridge count and orientation of the print are other details used in the identification process. These characteristics alone do not provide sufficient uniqueness to the print to individualize. Although the pattern classification eliminates non-matching prints, many partial prints found in the criminal investigation are so fragmented that the pattern areas do not show up at all. Thus identification
must be based on more detailed examination of the ridge characteristics, which are independent of the pattern this comprises the second level of detail. Some of the features that are studied are ridge endings, bifurcations, dots, enclosures, islands, bridges, lakes, crossings etc.

If sufficient numbers of these characteristics are found at their correlative positions in evidence prints and on prints taken from a suspect (Specimen) and if no differences are seen, the prints are considered to be from the same finger. Each feature can be identified in terms of type of pattern, its direction and its location with respect to other identifiable features in the print. These two levels of details are sufficient to establish identity of the print, but there are cases in which the print is too blurred or smudged for identification in the usual wage or an impression is so fragmentary that it is discloses only a very limited number of ridge characteristics such prints are chance prints where variations in conditions are so many that some other detail namely Third level of details are examined in such a prints. These details include Poroscopy and Edgeoscopy.

French criminologist Edmond Locard discovered the method of establishing identity by comparison of the sweat pores on palmer and planter surfaces are known as Poroscopy. These pores appear as minute openings on the mouth of the ducts of sweat glands. Sweat pores have great individual differences and they are persistent throughout life, an invaluable series of individual features which can be employed to the advantage of criminal investigation in cases where the record is too incomplete to show a definite pattern or too fragmentary to make out even the ridge details with certainty.

Certain factors such as quantity and quality of the ink used, the degree of the pressure applied in taking an inked print or how an article is touched, the smoothness of the friction skin etc. affects the visibility of sweat pores.

Sweat pores are situated on the ridges and vary in:-

(a) Shape of the pores
(b) Size of the pores
(c) Position of the pores
(d) Number of pores per unit area

The opening of sweat glands i.e. sweat pores are arranged on the ridges of friction skin and they can be of various shapes i.e. triangular, circular, oval or rectangular etc. They may be placed in the middle or at the periphery of the friction ridge. Like finger prints, the shape of pores and their relative position remains constant throughout life and they are variable in different finger prints.
The size of pores may vary with the advancement of age, but their nature and relative position remains constant. Number of pores per unit area can be calculated as the average number of pores that occur on the given length of the ridge or found within the given area.

In the present work the different features of the pores namely their shape, size and position in the areas of fingers have been studied in the inked prints.

Chatterjee in 1962 envisioned *Edgeoscopy* as an identification process where the characteristics of the edges of the ridges of friction skin would be compared and evaluated. These characteristics are the alignment and shape of the individual ridge unit. The edges of ridges are also unique and are persistent like ridges and pores. The characteristics of the edges of the ridges do not change during the life of an individual though their size can vary with the advancement of age.

Chatterjee, 1962 classified the characteristics of the edges (Fig-1) of the friction skin into seven classes:–

a) Straight edge.

b) Convex edge

c) Peaked edge

d) Table edge

e) Pocket edge

f) Concave edge

g) Angular edge

The types of surface on which these chance prints appear and the kind of ink used affect the visibility of these ridges.

To sum up, Holistic approach to identification of the friction ridge surface is required and is as follows:

- During the identifications experts presently tend to explain and demonstrate the identification only on the basis of number, and sometimes the type of ridge characteristic. The holistic approach explains and mentions further aspects. Persistence and uniqueness are the foundation on which the science of finger prints is based. If this is true for ridge flow and minutiae, it must follow that it is also true for the other aspects of ridge structure. The manner in which this information is used in the identification process is explained as follows:
The pattern formation is probably the first aspect that an expert is using in the identification of fingerprints but is very rarely mentioned in explaining the identification. For example, if an expert compares a loop pattern mark with a whorl pattern and if the two items being compared are of the same pattern, then this is considered as the first step in the identification process.

- **Second level**
  - Specific flow of the ridges;
  - Specific path of accidental features, such as scars, subsidiary ridges and flexion creases etc. and
  - The location of ridge characteristics

Identifications are currently processed on the basis of number and sequence of the ridge characteristics. Although ridge characteristics on subsidiary ridges are sometimes used, the fact that subsidiary ridges appear in two impressions is by itself an aspect that could be used in the identification process. Fingerprint experts would state that scars and flexion creases are never used in the identification process. However most of the experts agree that they are used in the searching and the initial stages of the identification process. All these are aspects of the identification process.
Most of the experts use number of characteristics and the coincident sequence to explain and demonstrate the identification.

**Third level**

- Third level detail is small shapes on the ridge (Edgeoscopy);
- Including ridge unit thickness, thinness and relative pore location (Poroscopy);
- Third level detail is always used in agreement with second level detail.

- This is the additional aspect that experts are expected to look for. As mentioned above, it is used along with the second level. It includes the items mentioned above and adds strength to explain and demonstrate identifications and/or non-identifications with a limited number of characteristics.

- The expert must evaluate the clarity of the print before forming an opinion.