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Original Research Article

A Comparative Study of Pocket Shape Edges of Ridges on both Right and Left Side Thumb Impressions between Male and Female Students at SRVS Medical College Shivpuri Central India

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Abstract

Introduction: The anatomy of fingerprints consist of ridges, edges on ridges, and different shapes of sweat pores. Ridges are of different shapes like concave, convex, peak, straight, table, pocket, angle, etc.

Materials and methods: The study will be carried out on 400 undergraduate students of both sexes in the Shivpuri region, Madhya Pradesh. (Central India). Prints of the Bilateral thumb finger would be taken with printer's ink and the thumbprints are taken on Executive bond paper treated with the chemical Ninhydrin· And focused under a microscope as latent prints.

Results: As per the present findings we found that the highest number of pocket shape edges are 1 in 1 cm ridge. Out of 200 males, 146 males show 1 pocket edge and out of 200 females 84 females show 1 pocket edge in a 1 cm ridge on the right side. Out of 200 males, 73 males show 1 pocket edge and out of 200 females 96 females show 1 pocket edge in a 1 cm ridge on the left side. It is also observed that in 113 males and 82 females' pocket edges are completely absent on the left side and in 52 males and 70 females' pocket edges are completely absent on the right side.

Conclusion: The study of shapes of edges of ridges of thumb impressions is the authentic method the for determination of sex in the field of criminology, forensic medicine anatomy, etc.

Keywords: Edgeoscopy, Ridgeology, Pocket Shape Edges, Anatomy, Forensic Medicine, Ninhydrin.

Introduction

Fingerprints are characterized by alternate strips of raised epidermal ridges and furrows present in the alteration of different patterns with microscopic structures known as sweat pores appearing along the whole surface of the dermal ridges. [1] These ridges can help in the identification of a person even when the epidermis gets eroded by damage due to burns or long-term (period) submerged in water. [2] Ridgeology is the examination of ridges of the friction surface of the skin

i.e. edges. and the study of edges on the ridges is known as edgeoscopy [3] Fingerprint patterns starts developing between fifth and sixth week of gestation period and fully formed by the end of twenty first week of gestation, and the sweat glands start to develop around fourteenth week of gestation and acquire adult morphology by the twenty fourth week.1The fingerprints of same individuals collected on dissimilar moment with gap of many years will not show any change in pattern on differentiation and they remain persistent for the entire life of individual [4]. The persistence of fingerprint patterns is supported biologically by studying embryology and microscopic histology of friction ridge skin Edges of ridges can be of different shapes such as concavity, angle, peak, straight etc The study of the clear pattern of latent prints (the prints which is not visible to naked eye) was developed by various standard methods using powder dusting methods and chemicals such as iodine fuming, silver nitrate reagent, diazoafluoren, nninhydrin and cyanoacrylate / superglue fuming development methods. [5] It is clear that the scientific studies of this important minute anatomical structures might helpful to many scientific discoveries in the field of physical and medical anthropology, medicine and anatomy.2Finger print features which can be divided in to three classifications, level one pattern represent general morphological information and ridge flow pattern , It is well documented that the general pattern taken by ridges is indirectly inherited. [6] Relative frequencies of general pattern types have been extensively studied in various groups of populations.[7] and in relation to numerous chromosomal deficiencies, genetically defects and diseases. [8-12] [level two features represent the minutiae information such as ridge endings and bifurcations, level three features obtained from the sweat gland pores and ridges present on the fingerprints. [13] Fingerprint patterns are unique to an individual which means they differ from one person to another person and even from one digit to another digit in the same person. Like ridge characteristics pores are immutable, permanent and individual. Given two finger prints may be similar in the type of main pattern and arrangement of ridges but they are not similar in all the details. The characteristics of fingerprint ridge patterns although having no scientific basis has been accepted through actual studies and statistical models. The fingerprints of identical twins were compared in 17 sets of twins and found to be differing in terms of ridge characteristics and occasionally even in overall pattern approximated that there are 1 in 64 billion chances of two fingerprints having similarity in pattern type. The specific design of friction ridges has never been found to repeat. [14] The variation in the width of the ridge, alignment of ridge units and location of pores make fingerprint patterns unique. [15]

The characteristics of the edges of ridges will not change during the life of an individual though their size can alter as of age increases. Chatterjee 1962 classified the characteristics of the edges (Fig-1) of the friction skin into seven classes. [16]

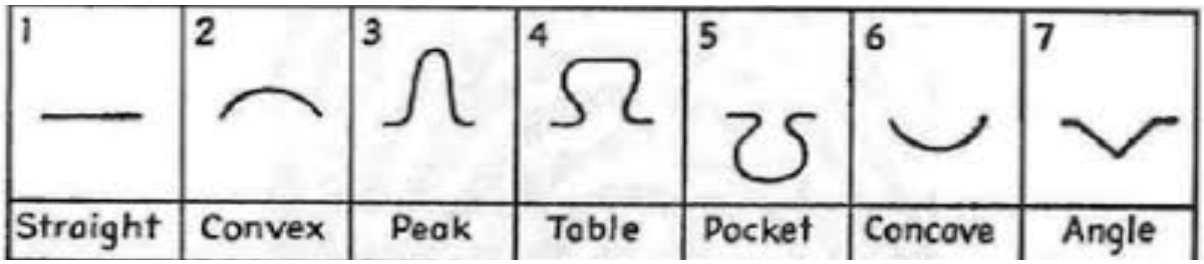

Figure 1: Types of edges.

Types of Fingerprints

Finger prints that can be found at the crime scene are of three types: visible prints, impressions and invisible prints these prints can be found on any object which is related to the crime scene. Any of these three types of fingerprints can be present at the site of crime scene. So one should always carefully consider the probability of presence of latent prints while studying other types of prints. [17]

(a) Visible fingerprints

This type of finger prints which are able to see through naked eye and can be studied directly provided adequate difference is there between the surface and the prints. It may require a source of light when contrast is poor. These prints may or may not require development method to increase the details of the prints. Visible prints may be found contaminated with dust ink, and blood etc. [18]

(b) Latent fingerprints

The prints which are not seen through naked eye but can be studied by some developing methods such as Chemicals, optical devices and powders are known as latent fingerprints. These prints form an essential tool of physical evidence at the crime spot when they are developed by suitable technique are useful in personal identification. Latent prints were obtained on the non-pours as well as pours surface such as paper, metal surface, and glass sheet, painted surface, glazed tiles etc [5]. The latent print impression is composed of sweat and contaminants from the surroundings [19]

Depending upon the appropriate concentration of Ninhydrin and appropriate solvent. The best results were obtained when 0.6% – 1% of Ninhydrin was added to Freon. Due to concerns about the ozone layer, heptane's started replacing Freon as a solvent. [14]

Silver nitrate reagent behind this method the mechanism is the chemical reaction of silver ions with the proteins present in the fingerprint remnant forming coloured products when they get exposed to light. This method shows well performance on the surfaces like newspapers but cannot be used in some situations where latent prints are found on a surface exposed to humidity. [20]

Materials and Methods for Data Collection

Study setting:

The study will be carried out on 400 under graduate students of Shivpuri region, Madhya Pradesh. (Central India)

Sample size:

A total size of 400 undergraduates shall be considered. [21]

Data collection

This present study is performed by making bilateral thumb print impressions of 400 under graduates (both males and females) students of Shivpuri region. Those students who are participating in this research we requested them to wash their hands properly with Dettol soap solution and remove any dust particles on thumb before taking finger prints [16]. All healthy undergraduate students with no history of genetic disorders only included in the present study [22] after selection of students bilateral thumb print will be taken.

For taking finger prints Bilateral thumb would be covered with ink and then the inked thumb shall be rolled from side- to-side on respective papers [23] the age, sex and name of each individual would be recorded in a register along with the prints [24].

The forensic use of ninhydrin for latent finger print development was first recommended by Oden and Von Hofsten This method is establish on the mechanism that α-amino acids, polypeptides and proteins present in the fingerprint remnant react with chemical ninhydrin producing Ruhemann's purple [25,26] different chemical formulations of ninhydrin solutions are available in which ninhydrin

are added to different solvents like acetone, ethanol, methanol, ethyl ester, heptane etc [21] The solution of Ninhydrin is applied on the print by various techniques like swabbing, Dipping and spraying and thereafter, the print is accelerated by using process of heating at 80º Fahrenheit in 80% relative humidity.

Materials

Prints of Bilateral thumb finger would be taken with printer's ink (Kores ink) and the above prints are subjected with chemical Ninhydrin [5,15] and studied under microscope [27] (latent prints) on the following Executive bond paper [5,28]:

The following items shall be used for taking bilateral thumb finger prints from donors:

- Printer's ink (*Kore's* ink) [16]
- Chemical – Ninhydrin (*Best* method for print on bond paper) [16]
- Royal executive bond paper [16].
- Binocular compound microscope with light source. [23]
- A sheet of thick glass was used on which both the hands can be kept.
- The rubber roller was used to spread the ink on glass which is obtained from local shop as per suggestion of forensic medicine department.
- The napkin was used to dry the hands of a person before spreading the ink.
- A Dettol soap was used to clean the hands before collecting bilateral thumb impressions and after collecting impression to clean the stain. [24]
- Magnifying glass [24]

Methods

Results

Finger prints with printer's ink:

Before taking the fingerprint all the individuals would be requested to wash their hand with Dettol soap solution to avoid any contamination. The napkin was used to dry the hands of a person before spreading the ink. With One of the above brand a small amount (Kore's ink) of printer's ink would applied onto washed glass slab and a thin uniform layer of ink was distributed over the glass slab by using an ink pad or roller. Standing at a forearm length from the paper the subject asked to give the prints. The paper labelled properly with the sample number (sample no -1), later the best print is taken for microscopic study under 10x magnification .which corresponds to the donors details like Name, Age, Sex etc. Prints would preserved carefully in a separate file in sequence so that they could be taken out easily. [29]

Microscopic study of bilateral thumb finger prints.

After collecting the finger prints name of the student, gender, age and their roll number are taken in a separate page along with finger prints and they are stored in a proper format in a file and one by one used for the study. Each finger print were subjected to chemical Ninhydrin for latent prints study.[5&15] The microscopic findings are recorded in a separate sheet for example number of pores per microscopic field, shapes of pores, position of pores, shape of the edges of ridges etc. and photo micrographic pictures were taken and later all the findings were filled in excel sheet and results are shown.

Table 1: Showing number of Pocket edge right side.

	Male	Female
0	52	70
1	146	84
2	2	41
3	0	2
4	0	3
Total	200	200

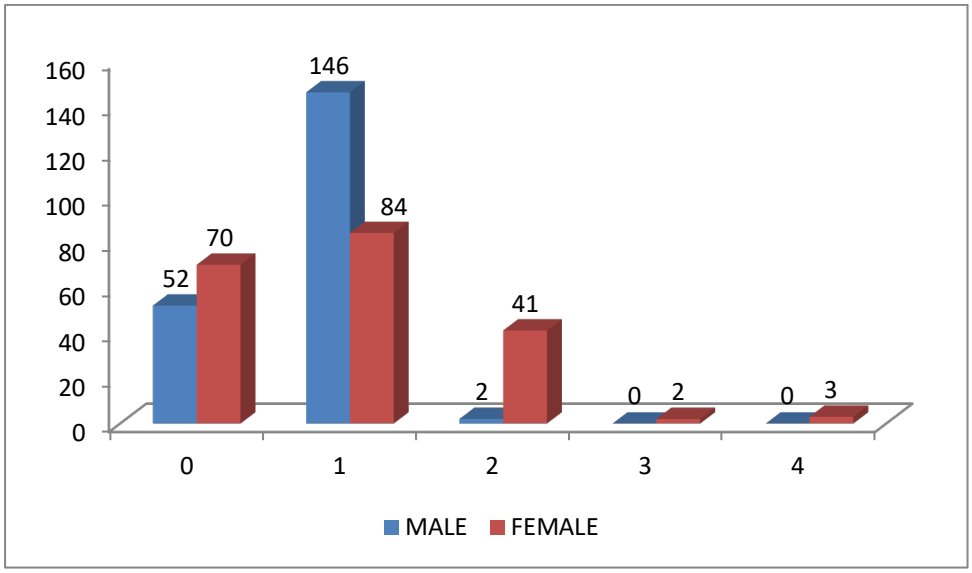

Chart 1: Number of pocket edges in 1cm ridge right side.

In The above table we observed the pocket edges present in 1 cm ridge in both male and females. We found the highest number of pocket edges are 1 in 1 cm ridge. Out of 200 males 146 males shows 1 pocket edge in 1 cm ridge. Which is higher than the female's .out of 200 females 84 female shows 1 pocket shape edge in 1 cm ridge.

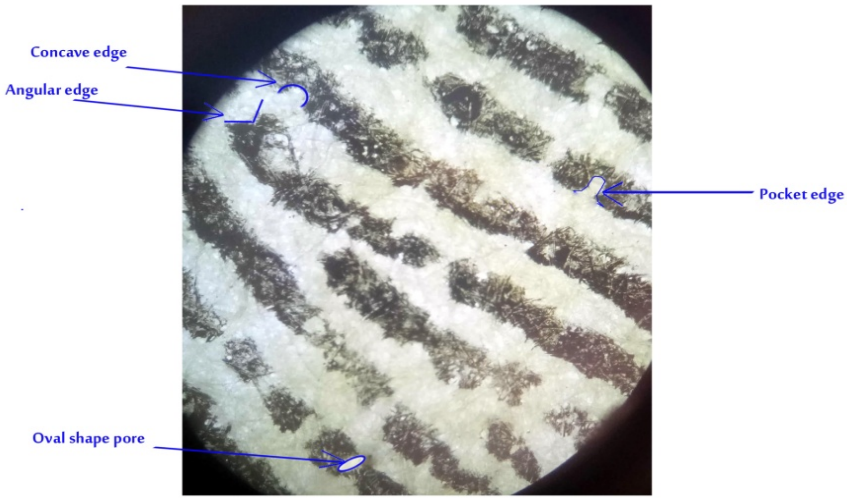

Figure 2: Showing pocket edge along with other edges of thumb impression (10X).

Table 2: Showing number of Pocket edge left side.

	Male	Female
0	113	82
1	73	96
2	14	22
Total	200	200

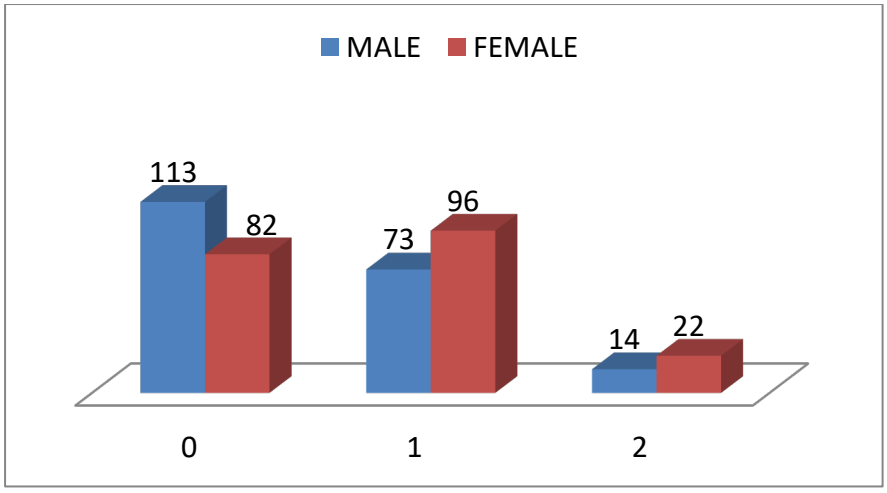

Chart 2: Number of pocket edges in 1cm ridge left side.

In The above table we observed the pocket edges present in 1 cm ridge in both male and females. We found the highest number of pocket edges are 1 in 1 cm ridge. Out of 200 males 73 males shows 1 pocket edge in 1 cm ridge. Which is higher than the female's .out of 200 females 96 female shows 1 pocket edge in 1 cm ridge. It is also observed that in 113 males and 82 females' pocket edges are completely absent.

	Mean	Std. Deviation	P- Value	Significance
Pocket Edges Right Side	0.70	0.66	2.45	p<0.05
Pocket Edges Left Side	0.70	0.66	2.83	p<0.05

In this study we found that the Pocket Edges Right Side and left side both are significant in t-test, we have using SPSS 24.0 in this study chart.

Pocket shape edges on both right and left side thumb impression

We observed that highest number of pocket shape edges are 1 in 1 cm ridge .Out of 200 males 146 males shows 1 pocket edge in 1 cm ridge. Out of 200 females 84 female shows 1 pocket shaped edges in 1 cm ridge. The ratio is higher in males compare to females on right side. On left side Out of 200 males 73 males shows 1 pocket edge in 1 cm ridge and out of 200 females 96 females shows 1 pocket edge in 1 cm ridge. The ratio is higher in females compare to males on left side. We also observed that highest number of pocket shaped edges are not seen on left side.

Pocket edge - According to present study highest range of pocket shape edges are 1 in 1cm ridge .on both right side and left side. Range in males are 73% and in females 42 % on right side. pocket shaped edges are more in number in males compare to females on right sides 36.5 % in males and 48 % in females on left side Percentage of pocket shaped edges on left side are more in case of females compare to males. On left side in case of males highest number of pocket edges are not seen. Absent range is more than present range in males on left side.

- Haroon neem khan observed 0-6 pocket shape edges range per photomicrograph and average number is 2.81 per photomicrograph per 100 samples. [16]
- Some studies also shows that females have great number of ridges than males [32]. If sufficient ridge characteristics are not available to study Poroscopy then Ridgeology can also be helpful for investigatios. [33]

Discussion

- Fingerprint formation has received significant response in the field of forensic sciences, anthropology,

forensic medicine, and anatomy and crime investigations.[1]

- Because of its unique nature that fingerprints remain unchanged throughout life of an individual. [34]
- Fingerprint extraction has always been given importance to identify the suspects as it serves as an identification and evidence in crime related cases because of its uniqueness and individuality. With technological advancement it has been wide use of fingerprints tracing and identification in order to achieve maximum personal security. Fingerprints are employed to achieve security in case of cell phones, attendance machines, biometric door locks Indian aadhar card.35 Fingerprint varies from person to person. Other importance of fingerprints include helps in diagnosis of certain genetic defects.23 And edgeoscopy are also helpful in gender determination by studying the number of pores and number of edges on the ridges. According to some studies there is a significant relationship between sweat gland pores and hypertension. [15]

Conclusion

In the present study we analyzed pocket and edges of ridges in between male and female undergraduates and also difference between right and left pocket and angle shape edges of ridges in both sexes. Our study may be useful For the purpose of identification of individual from finger prints and for sex determination in the field of forensic medicine, genetics and anthropology.

References

1. Wijerathne BTB. Poroscopy: an important research field in medicine and physical anthropology. Anuradhapura medical Journal. 2015; 9(2):44-46.
2. Gary L, Chunk L, RCMP, Prince Rupert BC. Finger tips: Use of dermal skin for identification. Identification Canada. 2004; 27(2):29-30.
3. Eugene czarnecki E. Poroscopy An overview. Reprinted from the April June 1995 scafo online article, July-August. 1995; 11(4):1-3.
4. Budowle, B., Buscaglia, J. and Perlman, R.S. Review of the Scientific Basis for Friction Ridge Comparisons as a Means of Identification: Committee Findings and Recommendations. Forensic Science Communications, 2006;8(1):16.
5. Bindra B, Jasuja OP, Singla AK. Poroscopy: A method of personal identification revisited. Anil Aggrawal's Internet Journal of forensic medicine and toxicology. 2000; 1(1): 01-11.
6. Holt S.B., The Genetics of Dermal Ridges. Newton Kugelmass, Ed., Springfield, IL: Charles C. Thomas. 1968;492.
7. Mavalwala J. Dermatoglyphics, an International Bibliography, Chicago: Mouton Publishers. 1977.
8. Wertelecki W., Plato C.C., and Paul N.W., Eds., Dermatoglyphics — Fifty Years Later, New York: Alan R. Liss. 1979; XV (6).
9. Loesch D.Z., Minutiae and clinical genetics, J. Mental Deficiency Res., 1973; 17, 97–105.
10. Loesch, D.Z., Quantitative Dermatoglyphics: Classification, Genetics and Pathology, Oxford: Oxford University Press. 1983.
11. Plato, C.C., Garruto, R.M., Schaumann, B.A., and Paul, N.W., Eds. Dermatoglyphics — Science in Transition, New York: Wiley-Liss. 1991; 27(2).
12. Durham N.M., Fox K., and Plato C.C., Eds. The State of Dermatoglyphics: The Science of Finger and Palm Prints, New York: E. Mellen Press. 2000;2.
13. Malathi S, Meena C. A novel approach for fingerprint recognition based on pores. International Journal of

computer science and research. 2010; 1(1): 10-14.
14. David. R. Ashbaugh, Identification Canada.1986;19(1):3
15. Abhishek Gupta The reliability of fingerprint pore area in personal identification, 2008.
16. Khan Haroon neem, identification from edgeoscopy and poroscopy in the examination of partial fingerprints and their significance in crime investigation, department of forensic science Punjabi University, Patiala, October 2011.
17. Brown E. W., The Cyanoacrylate Fuming Method. NU-ENG, [online]. Available from: http://www.ccs.neu.edu/home/feneric/cyanoacrylate. 1990; 2007.
18. A comparative study of characteristic features of sweat pores of finger bulbs in individual. bhoopesh kumar sharma,gupta Egyptian journal of forensic sciences. 2019; 9:43.
19. Lennard, C. The Detection and Enhancement of Latent Prints. 13th INTERPOL, Forensic Science Symposium, Lyon, France, 2001; D2-86 to D2-98,
20. 20) Lee, H. L. and Gaensslen, R. E. Advances in Fingerprint Technology. 2nd ed.Boca Raton, Florida, CRC Press. 2001.
21. Asis K et al dermatoglyphics a method of sex differentiation – a study. Journal of evolution of medical and dental students, 2015;4(49):8461-8465.
22. Tanuj Kanchan, Saurabh Chattopadhyay. Distribution of Fingerprint Patterns among Medical Students. JIAFM. 2006:28(2): 65-68.
23. Biological Variability of Sweat Gland Pores in the Fingerprints of a Fars Iranian Family from Khorasan Razavi Province, Iran Mariam Tafazoli, Nasser Mahdavi Shahri, Hamid Ejtehadi, Farhang Haddad, Hadi Jabbari Nooghabi, Mehrnoosh Mahdavi Shahri, B.S, Somayeh Naderi, May. 2013;10(2): 99-104.
24. Dr. Mukesh Kumar Thakar, HaroonNaeem Khan & Pawan preet Kaur. Identification of authorship using lateral palm prints by studying third level details, Anil Aggarwal's Internet Journal of Forensic Medicine and Toxicology. 2013;14(1).
25. Parthasaradhi STV, Derakhshani R, Hornak LA, Schuckers SAC. Time-series detection of perspiration as a liveness test in fingerprint devices. IEEE T. 2005; 35: 335-43.
26. Oddy AR, Stosz JD. Fingerprint features-statistical analysis and system performance estimates. pro IEEE T. 1997; 85: 1390-42
27. Locard, E. Le sixième congrès d'anthropologie criminelle, Archives d'Anthropologie Criminelle, de Médecine Légale et de Psychologie Normale et Pathologique, 1906; 21: 865–873.
28. Durham N.M., Fox K., and Plato C.C., Eds. The State of Dermatoglyphics: The Science of Finger and Palm Prints, New York: E. Mellen Press. 2000; 2.
29. Cummins H, Midlo C. Fingerprints, palms and soles: an introduction to dermatoglyphics. New York: Dover Publications; 1961.
30. Krzysztof K. M., Morier P. and Drygajlo A., Study of the Distinctiveness of Level 2 and Level 3 Features in Fragmentary Fingerprint Comparison. Proceedings of the Second COST Action 275 Workshop, Vigo, Spain, 2004; 83-88.
31. Almog J., Sasson Y. and Anati A., Chemical Reagents for the Development of Latent Fingerprints II: Controlled Addition of Water Vapor to Iodine Fumes – A Solution to the Aging Problem. Journal of Forensic Sciences, 1979;24: 431-436.
32. Wilder HH, Wentworth B. Personal Identification: Methods for the Identification of Individuals, Living or Dead. Boston: RG Badger, 1918.
33. Cowger JF. Friction Ridge Skin: Comparison and Identification of

Fingerprints .1st Ed. United States of America: CRC Press, 1992.
34. Puri, D.K.S. Complément à quelques réflexions dactyloscopiques, Revue Internationale Police Criminelle. 1964; 19(178): 130–134.
35. Ferguson, N. Minutiæ discrepancy in the delta area, Fingerprint World. 1992; 18:110.