RESEARCH ARTICLE

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Reassessing Poroscopy: Obsolete or Underrated? A Research Article

Venugopal T[1], Gambhir OS[2*]

[1]Intern, SRMMCH, Chennai, India.

[2]Professor & Head, Department of Forensic Medicine & Toxicology, AIIMS Kalyani, Nadia, West Bengal, India

Abstract

Poroscopy, the study of sweat pores on friction ridge skin, is an important sub-discipline of dermatoglyphics with applications in forensic science and biometric identification. Despite its established forensic value, limited data exist on poroscopic patterns in young adult populations, particularly among medical students.

To analyse the poroscopic patterns in fingerprints of 200 undergraduate medical students and evaluate any variations based on sex and digit type.

A cross-sectional observational study was conducted among 200 undergraduate medical students (100 males and 100 females). Fingerprint impressions were collected using standard ink methods. Pore characteristics—including pore frequency, shape (round, oval, elongated), arrangement, and position—were analysed under magnification. Statistical analysis was performed to determine sex-based and digit-based differences.

The average pore frequency per centimetre was significantly higher in females compared to males ($p < 0.05$). Round pores were the most prevalent shape across all fingers, while elongated pores were the least common. A notable asymmetry in pore distribution was observed between dominant and non-dominant hands. The middle and index fingers showed the highest pore density. No significant association was found between pore pattern and academic stress or lifestyle factors.

The study establishes baseline poroscopic patterns among young Indian adults in a medical academic setting. Findings suggest gender and finger-based variation in pore characteristics, supporting the forensic relevance of poroscopy in individual identification. Further research with larger, more diverse populations is recommended to expand on these observations

Keywords: Sweat pores, fingerprints, Poroscopy, identification, forensic medicine

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Introduction

Poroscopy is a personal identification method that involves comparing the impressions of sweat pores on the friction ridges of the palmar and plantar surfaces. The method was discovered and developed by Sir Edmond Locard in 1912.[1,2] He observed that, like the ridge characteristics, the pores are also permanent, immutable, and individual specific, and thus these are useful to establish the identity or otherwise of individuals when available ridges do not provide sufficient ridge characteristics. It comes under level 3 of fingerprinting. Fingerprint matching can be done at three levels; the first deals with macro features like pattern type, ridge count, core, delta, and orientation. Level 2 comprises comparing the relative nature and position of ridge characteristics, also known as Galton's minutiae. Individualisation can be achieved at this stage. Level 3 focuses on the use of intra-ridge details or microfeatures like sweat pores, edge contours, friction ridge width, dots, incipient ridges, creases, and scars.[2-4]

Sir Edmond Locard began to study Poroscopy as a result of a break-in and theft. A rosewood jewellery box, which had held the stolen jewellery, was found to be covered with fingerprints. Several latent prints were obtained, and two people, identified by the names of Boudet and Simonin, were suspected of having committed the crime.[4-6] The prints lacked an overall pattern configuration, and the convicts would not have confessed to the crime. Then, Sir Edmond Locard compared both the prints and observed that the first accused's prints contained 901 pores, and the second accused's palm print contained 2000 pores in their relative position. Based on this, both men were convicted and sentenced for that theft.[2,7,8]

Sir Edmund Locard reported that the ridge characteristics present on the fingerprint patterns are permanent, immutable and individual specific. Similarly, the pattern of sweat pores is permanent and individual-specific. These pore characteristics are useful for the establishment of the identification of an individual, especially when the finger ridges are not sufficient to provide sufficient ridge characteristics.[9-11] Locard proposed factors for the analysis of the pores for personal identification. The factors of pores, like number, frequency of pores per unit

Corresponding Author: Gambhir OS, Intern, SRMMCH, Chennai, India ,Professor & Head, Department of Forensic Medicine & Toxicology, AIIMS Kalyani, Nadia, West Bengal, India, e-mail; drgambhirsingh@gmail.com

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area, the distance between two pores, size, shape and position of the pores, are useful in the study of poroscopy. The main purpose of the present study is to study these characteristics of pores and to help in the establishment of identification of an individual.[4,12,13]

Material & Methods

The present study is based on inked fingerprints and palm prints of two hundred undergraduate medical students. After explaining the whole procedure in the vernacular of the individuals, we collected their written consent in the presence of a witness. For this study, we included 200 undergraduate medical students, 100 males and 100 females, in the age group of 21 to 23 years. Details of each individual, such as name, age, and sex, were recorded. Those students who refused to consent were excluded from the present study. The left-hand thumb was used for the print collection and analysis. The hands were washed thoroughly with Dettol soap before collecting the prints. We used Kore's Printer's ink to take prints of the left thumb impressions. Later on, these prints were treated with Ninhydrin Chemical. For latent fingerprints, we used plain glass slides.

These fingerprints were examined under the stereo microscope at 40X magnification to study the different pores. The features of pores used in the analysis include the number of pores, size, shape, the interspacing between them, and their position on the ridge. The number of pores can be calculated in two ways, i.e., average number of pores per unit length and per unit area. The results were tabulated for easy analysis and comparison with the previous studies.

Result

In Case of Visible (inked) Prints

Number of pores

On average, there were about 7 to 24 pores on one centimetre ridge. The maximum number of pores was seen in the outer side of the digital pad and the hypothenar area, 106 cases (53%). The minimum number of pores was seen on the thenar aspect, 19 cases (9.5%). In the present study, more pores are seen in females than in males.

Interspacing between Pores

In the majority of the cases, we observed that the pores were arranged one after another in a line with almost uniform interpore space, 112 cases (56%). In a few cases, pores were found to be arranged side by side of a ridge, 15 cases (7.5%), and the interspace was also found to be irregular, 8cases (4%). In 5 cases (2.5%), pores were found to be connected without any interspace, giving a chain-like appearance.

Size of pores

The sizes are very variable, at some places pores are very large and at other places very small. Even on one ridge, we observed pores of various sizes. So, we grouped these pores into large, 70 cases (35%), medium, 98 cases (49%) and small, 32 cases (16%) instead of studying by measuring every pore. However, medium-sized pores were most frequently observed in the present study.

Shape of pores

The shape of pores is quite variable, even on the same ridge. Some pores are rounded (seen in 68cases, 34%), oval (seen in 54 cases, 27%), some are rhomboid (seen in 45 cases, 22.5%), and others are elliptical (seen in 58 cases, 29%). Some pores were triangular (seen in 43 cases, 21.5%) in shape. In 5 cases, it was square. However, the most commonly encountered shape in all print was the round or oval shape.

Position of pores

We observed that pores were situated either in the middle of the ridge or on the outer side of the ridge towards to furrows. The pores lying along the middle of the ridges have clear-cut, intact boundaries. Those pores lying along the periphery show intact boundaries as well as incomplete or broken boundaries. Those pores with intact boundaries are known as closed pores, and those with broken or incomplete boundaries are known as open pores. In the present study, closed pores are more commonly seen in 64 to 80% of the cases.

In cases of Latent Prints

The analysis of these latent prints was conducted after processing with Ninhydrin to convert them into visible prints. Such a developed print was studied by analysing various pores and compared with that of the inked prints. In the present study, the majority of the pores were rounded or oval in shape, and our study is in concurrence with the study conducted by KR Nagesh[3] and D.S. Preethi.[8]

Discussion

This method of identification is especially useful when the recovered prints are blurred, incomplete, overlapping or contain a low number of minutiae.[1-4]

In the present study, we observed that the number of pores is comparatively higher in females, and a similar observation was also reported by Preethi *et al.*[8.] If the number of pores is more than 9/25 sq.mm. It is more likely a female, and if it is less than 8pores/25 mm, then it is more likely from a male.[14,15]

Different studies reported that the size of pores ranged from 88 to 220 µm in diameter.[7,12] The size of the pores is not useful in identification as it changes based on their physiological activities.[9,15,16]

In the present study, we observed an average about 7 to 24 pores per centimetre of epidermal ridge. Similar findings were also reported by Bindra *et al.*[5], O'Leary *et al.*[6] and by Ashbaugh [7]

The pores are mostly situated either on the middle or the periphery of the papillary ridge. This finding is consistent with the work of Ashbaugh.[7]

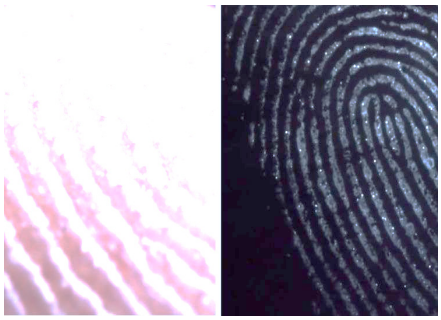

Figure 1: Rounded & oval shaped pores (400X)

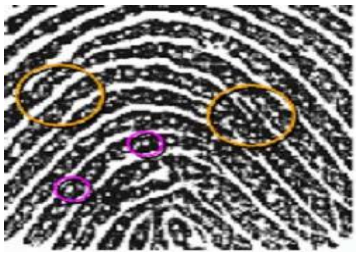

Figure 2: Square-shaped pores (400X)

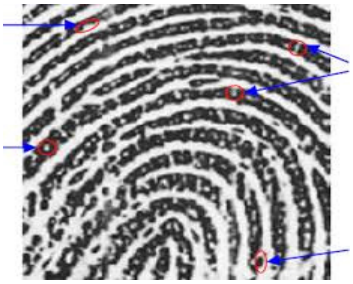

Figure 3: Rhomboid: Shaped pores (400X)

Owing to the elasticity and compressibility of the skin, there may be changes in the shape, size and type of the spores; however, the interspace between pores is constant.[7] Even during the flexion, the pores remain more or less constant, maintaining their distance.[7]

In the present study, we observed pores of various shapes like rounded, oval, triangular, elliptical, rhomboid and square. Various shapes of pores were also reported by Ashbaugh[7] and Bindra *et al*.[5.] In a study conducted by Bindra *et al*.[5] reported that rhomboid-shaped pores were most abundant, which was followed by round, elliptical, and rectangular-shaped pores. It was reported that pore shape is not a reproducible feature[9-11] because distortions caused due to pressure change will affect the basic shape of the pores. The type and shape of pores have no significant difference between the sexes.[5,14,16-19]

Conclusion

To conclude, the science of poroscopy is largely unexplored. The same can be understood by the search results, which show a dearth of available research data on poroscopy, thereby emphasising the need to conduct more work in this field. Forensic science is the science of justice, and evidence, no matter how minute, should never be overlooked. Sweat pores are a part of the valid information provided by fingerprints and should not be ignored. They are difficult to mimic, present in abundance and are permanent. If the limitations can be overcome as discussed before, they can act as a competent tool for facilitating personal identification when used along with ridge characteristics.

REFERENCES

1. Cai L, Xia MC, Wang Z, Zhao YB, Li Z, Zhang S, Zhang X. Chemical visualization of sweat pores in fingerprints using GO-enhanced TOF-SIMS Anal.Chem. 2017; 89(16): 8372-8376.
2. Gupta A, Sutton R. Pore sub-features reproducibility in direct microscopic and livescan images—their reliability in personal identification.J. Forensic Sci. 2010; 55(4):970-975
3. Nagesh KR, Bathwal S, Ashoka B. A preliminary study of pores on epidermal ridges: are there any sex differences and age-related changes? J. Foren. Leg.Medicine, 2011; 18(7):302-305
4. Zhao Q, Zhang D, Zhang L, Luo N. High resolution partial fingerprint alignment using pore–valley descriptors. Pattern Recogn. 2010; 43(3):1050-1061
5. Bindra, Jasuja OP, A. Singla A. Poroscopy: a method of personal identification revisited Anil Aggrawal's Internet J. Forensic Med. Toxicol. 2000; 1(1).
6. O'Leary E, Slaney J, Bryant D, Fraser F. A simple technique for recording and counting sweat pores on the dermal ridges.Clin. Genet. 1986; 29(2):122-128.
7. Ashbaugh DR. Quantitative-qualitative Friction Ridge Analysis: an Introduction to Basic and Advanced Ridgeology.1999; CRC.
8. Preethi DS, Nithin MD, Manjunatha B, Balaraj BM. Study of poroscopy among South Indian population. J. Forensic Sci. 2012; 57(2):449-452.
9. Anthonioz A, Egli N, Champod C, Neumann C, Puch-Solis CR, A. Bromage-Griffiths. Investigation of the reproducibility of third-level characteristics.J. Forensic Ident. 2011; 61(2): 171.
10. Zhao Q, Feng J, Jain AK. Latent fingerprint matching: utility of level 3 features.MSU Tech. Rep. 2010; 8:1-30.
11. .Monson KL, Roberts MA, Knorr KB, Ali S, Meagher SB, Biggs K, Blume P, Brandelli PD, Marzioli A, Reneau R. The permanence of friction ridge skin and persistence of friction ridge skin and impressions: a comprehensive review and new results. Forensic Sci. Int. 2019; 297: 111-131.
12. Roddy AR, Stosz JD. Fingerprint features-statistical analysis and system performance estimates.Proc. IEEE, 1997; 85(9):1390-1421.
13. Roddy AR, Stosz JD . Fingerprint features-statistical analysis and system performance estimates. Proc. IEEE, 1997; 85(9):1390-1421.
14. Faulds H. Poroscopy: the scrutiny of sweat-pores for identification Nature, 1913; 91 (2286): 635
15. Kaur J, Dhall M. Reproducibility of fingerprint microfeatures. Egypt. J. Food Sci. 2022; 12 (1):1-9.

16. Preethi DS , Nithin MD, Manjunatha B, Balaraj BM. Study of poroscopy among South Indian population. J Forensic Sci. 2012 Mar;57(2):449-52.
17. Bhagwat V , Kumar DM, Lakshmi KNV. Poroscopy – The Study of Sweat Pores among Central Indian Population. Sch Int J Anat Physiol, June, 2020; 3(6): 53-56.
18. Patel A, Meena P, Sharma A, Tripathi A. Poroscopy: Study of Sweat Pores in Central Indian Population. Int J of Research Publication and Reviews, Jan'2023; 4(1),721-723.
19. Sharma BK, Bashir R, Hachem M, Gupta H. A comparative study of characteristic features of sweat pores of finger bulbs in individuals. Egyptian Journal of Forensic Sciences 2019; 9:43.