A Closer Look at Selected Malaysian Palm Prints Pattern

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ABSTRACT: The use of palm prints as an alternative to fingerprints for positive human identifier has recently gained much interest in the forensic arena. Palm prints consist of general features such as principle lines, wrinkles and creases that can be used to characterize an individual. In this study, 240 palm prints were randomly collected from normal and healthy individuals. Data analysis was affected using Statistical Package for Social Science (SPSS) software. Differences in ridge flow characteristic among four different Malaysian populations; Malay, Chinese, Indian as well as natives of Sabah and Sarawak were observed. Correlation study was performed to obtain a relationship between right palm print patterns to left palm print pattern. The presence of characteristic features such as vestige in thenar region, delta shift in hypothenar region and deltas in the interdigital region were found to be unaffected by the racial group of the individual. However, a good correlation of right palm print pattern to left palm print pattern was observed whereby the right hypothenar correlated well (r=0.93) to the left hypothenar as well as the right interdigital (r =1.00) to the left interdigital patterns. Based on the findings of this study, palm print can be used as an attractive identifying tool due to the uniqueness and distinctive pattern that differs from one person to another.

Keywords: palm prints pattern, ridge flow characteristic, SPSS software

Introduction

Just as fingerprints found at a crime scene are essential in identifying suspects, so are palm prints. The first recorded systematic capture of hand and finger images that were uniformly taken for identification purposes was when Sir William Herschel, working for the Civil Service of India, back in 1858 recorded a handprint on the back of a contract for each worker to distinguish employees from others who might claim to be employees when payday arrived [1]. Surveys of law enforcement agencies indicated that at least 30% of the prints lifted from crime scenes, called latents are of palms, not fingers [2]. Palm print is defined as the skin patterns of a palm, composed of the physical characteristics of the skin patterns such as lines, points and texture. Palm prints consist of general features such as principle lines, wrinkles and creases that can be used to characterize an individual [3]. A palm print can be either an online image (i.e. taken by a scanner, or CCD) or offline image where the image is taken with ink and paper.

Palm print recording and identification for law enforcement purposes has been in existence almost as long as fingerprint system. Until recently, the use of palm prints as an alternative to fingerprints for positive human identifier has gained much interest in the forensic field. Palm print has attracted an increasing amount of attention because it has several advantages: palm prints are abundant of line features; low-resolution imaging can be employed; faking a palm print is quite difficult because the texture is very complicated and one seldom leaves his/her whole palm print somewhere unintentionally [4].

Previous papers have covered a background on biometrics and the use of fingerprints as a biometric measure. While the science of fingerprints recognition has been almost well established [5], the complete theory of palm print recognition approaches are still being established or are less well known especially in Malaysia. Apart from that, fingerprint features are used officially in criminal investigations and commercial transactions, most of the users are unwilling to deliver their fingerprint data [6] to a company or system

for privacy reason. This would make palm print an attractive alternative and a field or topic to research further. In this study, palm prints of four Malaysian racial groups: Malay, Chinese, Indian as well as natives of Sabah and Sarawak were examined. Data analyses were affected using Statistical Package for Social Science (SPSS) software. Correlation study was also performed to obtain a relationship between right palm prints pattern to left palm prints pattern.

Material and methods

Each respondent were initially given questionnaires to fill in. Then, right and left palm of an individual were inked by using a stamp pad. Palm prints were taken by pressing both of the palms onto a white A4 paper placed on an even surface. Each respondent was requested to apply pressure starting from the wrist area and then extended to the rest of palm and finally to the fingers. Each individual was also required to apply even pressure so that all the features from the palm

could be deposited onto the white paper. Macroscopic examination of palm prints were carried out so that the physical features of palm print can be closely examined. To observe the features, a magnifying glass (with 5x magnification) was used under normal lighting condition. The features examined were vestige in thenar region, delta region in hypothenar region and the presence of 3 deltas, 4 deltas and 6 deltas in interdigital region.

Data analysis

Palm prints patterns were categorized according to the three basic regions which are thenar, hypothenar and interdigital region (Figure 1). The features observed in thenar region were the presence of vestige while in hypothenar region was the presence of delta shift. The presence of 3, 4 or 6 deltas were examined in the interdigital region. Data were then analyzed using SPSS statistical software version 19.
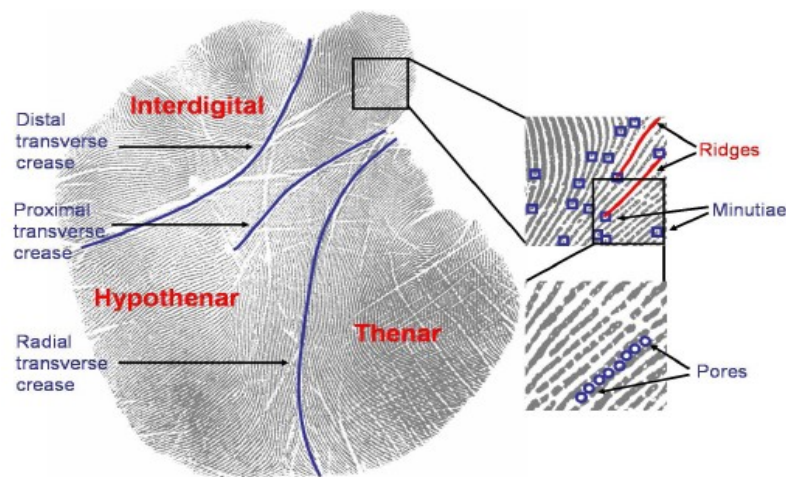

Figure 1: Three basic regions of a palm print showing major creases, ridges, minutiae and pores.

Results and discussion

The characteristic patterns investigated were the presence of vestige in thenar region, presence of delta shift in hypothenar region and the presence of 3, 4 and 6 deltas in the interdigital region. The vestige and delta shift are patterns that rarely found among individuals. Deltas exist in the interdigital region (Figure 3) of the palm. Most of the human populations have 4 deltas. Figure 2 shows the presence of vestige in left thenar while Figure 4 shows the presence of 4 deltas in the interdigital region.

Figure 2: Vestige in left thenar region

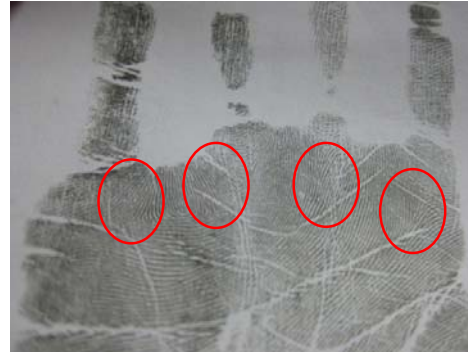Figure 3: Delta shift in right hypothenar region

Figure 4: Four deltas in interdigital region of left palm

Majority of the respondents were female (61%) while 39% were male. Table 1 summarizes the amount and percentage for the palm print feature according to different races. Majority have vestige on left palm thenar (l2%) compared to right palm thenar (8%). The majority of respondents have delta shift on right hypothenar (25%) while 23% of them have it on their left hypothenar. Other than that, majority of respondents have 3 deltas on their interdigital region (81%) while 14% respondents have 4 deltas. Only 5% of respondents have 6 deltas on both of their palms. Figure 4 shows the bar chart of the frequency of palm print patterns among Malaysian respondents of this study.
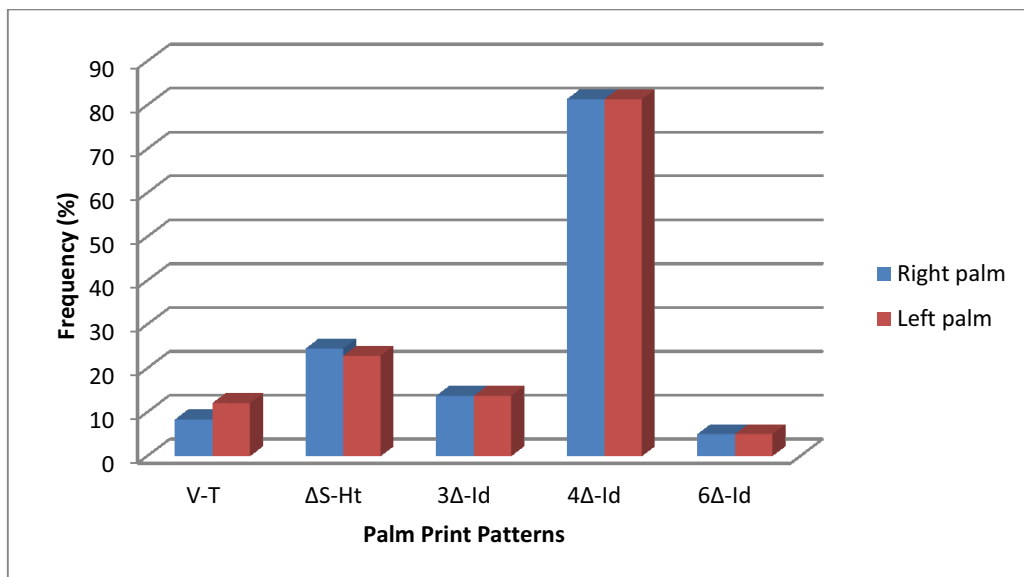

Figure 4: Frequency of characteristic palm print patterns among Malaysians where V-T indicates vestige in thenar region; ΔS-Ht indicates delta shift in hypothenar region; 3Δ-Id, 4Δ-Id and 6Δ-Id refer to 3 deltas, 4 deltas and 6 deltas in the interdigital region, respectively.

Cramer's V correlation was employed to see whether there exists a significant correlation between vestige in thenar right and vestige in thenar left palm. Thenar in left palm is less correlated to right palm ($r = 0.536$, $p<0.05$). An interesting finding is that majority of sample do not have vertige in both palms, account for 94 % of sample. Only 14 (6%) of them possess vertige in both palms.

Cramer's V correlation was also employed to obtain a correlation between the delta shift on right and left hypothenar. Results show that delta shift in left hypothenar is highly correlated to right palm ($r = 0.932$, $p<0.05$), meaning that if someone is found to be having a delta shift on left palm, he/she will also have delta shift on right palm or vice versa. It is also noted that only 54 samples (22%) have

delta shift in both of their palms, while majority of them (75%) do not show delta shift in both palms.

Consequently Spearman correlation was carried out to examine whether there exists significant correlation between delta in interdigital right and delta in interdigital left palm. Spearman correlation was employed since the types of data are ordinal. The result of Spearman's correlation shows a relationship between interdigital left and right palm. The results of this study revealed that Spearman correlation is highly significant ($r=1.000$, $p<0.05$), whereby an r-value equals to unity shows a perfect correlation. This indicates that for individuals with 3, 4 or 6 deltas present on their left palm, they will also have the same 3,4 or 6 deltas on their right palm.

Results of this study is rather different from a study done by Ismail et al. [7] who compared the variability of palm dermatoglyphs in three main populations i.e. Malay, Chinese, Indian and five sub-ethnic population of Negritos. They concluded that races, patterns and patterns frequencies were related to each other and can be used to differentiate the different races. All subethnics/races have their own uniqueness. The researchers utilized the palms of healthy adult individual to do a-b ridge counts (a-b-RC) on palms.

Conclusion

Based on the findings of this study, palm print can be used as an attractive identifying tool due to the uniqueness and distinctive pattern which are different from one person to another. The presence of characteristic features such as vestige in thenar region, delta shift in hypothenar region, number of deltas in the interdigital region were found to be unaffected by the racial group of the individual. However, a good correlation of right palm print pattern to left palm print pattern was observed whereby the right hypothenar correlated well ($r=0.93$) to the left hypothenar as well as the right interdigital ($r =1.00$) to the left interdigital patterns.

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