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A New Innovative Technique for Analysis of Palmar Dermatoglyphics in Oral Leukoplakia Patients

Lakshanika*, and Nalini Aswath.

Department of Oral Medicine and Radiology, SreeBalaji Dental College and Hospital, Chennai, Tamil Nadu, India.

ABSTRACT

Palmar Dermatoglyphics (PD) are assumed to be genetically controlled and they are unaffected by the environment, hence they can be used an ideal marker for individual identification, also aids in the detection of defects due to intra-uterine irregularities. To analyze qualitative [finger ridge pattern and hypothenar pattern] and quantitative [mean ATD angle and total AB ridge count] variations in PD in oral leukoplakia (OL). PD was recorded from 30 OL patients (group I) and 30 tobacco using patients but without lesion (group II) and were evaluated qualitatively and quantitatively. Finger ridge pattern were analyzed using One-way ANOVA, hypothenar pattern using Fisher exact test and ATD angle using Independent t-test. Highly significant difference among the finger ridge, hypothenar pattern and mean ATD angle ($P<0.001$) and total AB ridge count ($P<0.005$) between group I and II were obtained. There is predominance of loops, presence of hypothenar pattern, decrease in mean ATD angle and total AB ridge count in group I compared to group II. PD can be used as a tool for predicting the high risk groups who are prone for cancer. Hence further study in large sample for confirmation of the same is necessary.

Keywords: Dermatoglyphic, AB ridge count, ATD angle, hypothenar pattern, leukoplakia, palm prints.

Corresponding author

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INTRODUCTION

Dermatoglyphic is defined as the study of epidermal ridges and their patterns. The term is coined by the anatomist Cummins (1926) which means “a skin carving.” A complete system with rules for classification of fingerprints was formulated by Sir Francis Galton way back in 1892. [1]

Dermatoglyphics comprises the varied and intricate patterns present on the skin surface in man and other mammals.[2] These configurations are unique and are readily classifiable marks that can be used to distinguish one individual from another. PD are formed embryologically between the 10th and 17th weeks of intrauterine life; hence, the dermatoglyphic traits depicts prenatal developmental stability. Most significantly they remain constant from before birth until death unaffected by any constitutional or environmental disturbances.[3]

PD are assumed to be genetically controlled, although the exact mechanism of inheritance is still unknown. Various dermatoglyphic studies had been conducted in genetically inherited diseases such as Down’s syndrome, leukemia, schizophrenia, diabetes, hypertension, epilepsy and cleft lip and cleft palate.[4,5] Dermatoglyphics patterns were also used previously in the study of other chromosomal diseases, cardiac diseases, and leukemia.[6]

In dentistry, the data correlating with PD is less. Studies related to Oral diseases such as oral cancer, bruxism, dental caries,[7] dental fluorosis, etc., also showed a characteristic PD pattern.

Over the past 150 years, in addition to being the best and most widely used method for personal identification, PD has been a useful tool in biology, medicine, genetics and evolution.

Hence the present study was done to analyze the qualitative and quantitative variations in PD among tobacco users without any lesion and with having OL (fig 1).

Fig 1: Clinical image showing erythro leukoplakia of left buccal mucosa

MATERIAL AND METHODS

Source of data

Subjects were selected from the outpatient Department of Oral Medicine and Radiology.

Method of collection of data

In this study, 60 individuals were selected. Study consisted of 2 groups. Patients were divided into following groups:

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Group I: 30 patients – Tobacco users with Oral leukoplakia
Group II: 30 patients – Tobacco users with no lesions

An informed consent was obtained from the subjects. A detailed case history with thorough clinical examination was done, and findings were recorded in a prepared case history Proforma. The clinically diagnosed cases of OL proved histopathologically were included in the study.

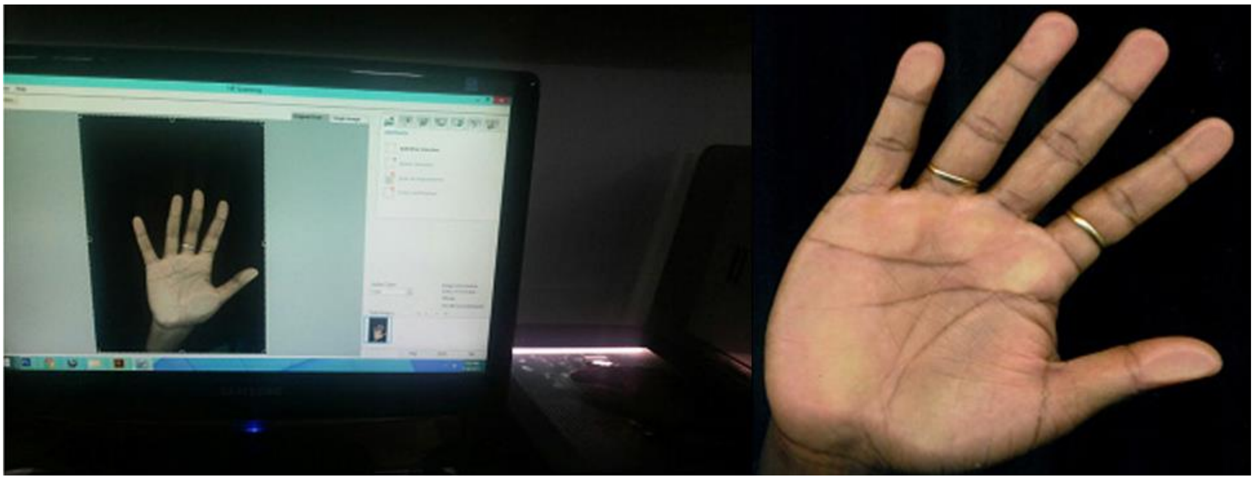
Inclusion criteria: Tobacco users with and without OL (group I and group II)

Exclusion Criteria:

Patients having systemic diseases such as diabetes, hypertension, heart diseases, bronchial asthma, epilepsy, anemia, congenital diseases like congenital heart disease, patients having genetic disorders, and those having other malignant conditions were excluded. Patients not willing to participate in the study were also excluded from the study.

The palm prints were recorded using a Canon MPC505 scanner. The patients were asked to place the palm gently without pressure over the scanning surface on the scanner with the fingers wide apart from each other [Figure 2]. After scanning, the images of the finger and palm prints were edited in the photoshop, and the following observations were made:

Fig 2: Finger prints were recorded using Canon MPC scanner and the scanned image respectively.



Quantitative analysis: [8]

Ridge counts

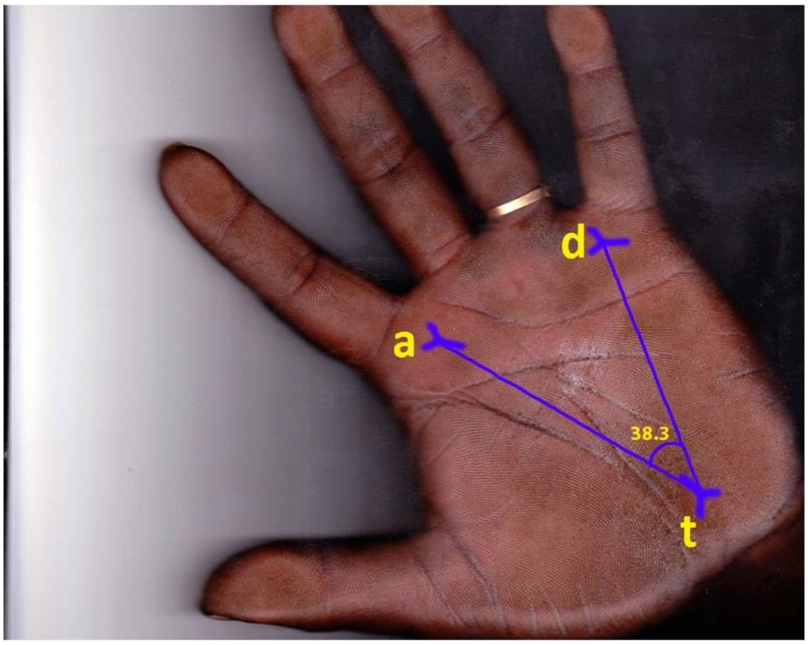
Ridges of the digital areas of the palms are often counted between two digital triradius. The most frequently obtained ridge count is between triradii a and b and is referred to as the a-b ridge count. Counting is carried out along a straight line connecting both triradial points (fig 3a). The count excludes the ridges forming the triradii. Otherwise, the counting is done according to the same principles as applied in ridge counting on the digits.

atd angle:

Perhaps the most widely used method is based on the atd angle (Fig. 3b). This angle is formed by lines drawn from the digital triradius a to the axial triradius t, and from this triradius t to the digital triradius d. The more distal the position of t, the larger the atd angle.

Fig 3a: Measuring a-b ridge count using Photoshop software.

Fig 3b: Measuring atd angle using photoshop software



Qualitative analysis:[9]

Fingertip patterns

The ridge patterns on the distal phalanges of the fingertips are divided into the three groups: arches, loops, and whorls (fig 4)

i) Arches: It is the simplest pattern found on fingertips. It is formed by succession of more or less parallel ridges, which traverse the pattern area and form a curve that is concave proximally. Sometimes, the curve is

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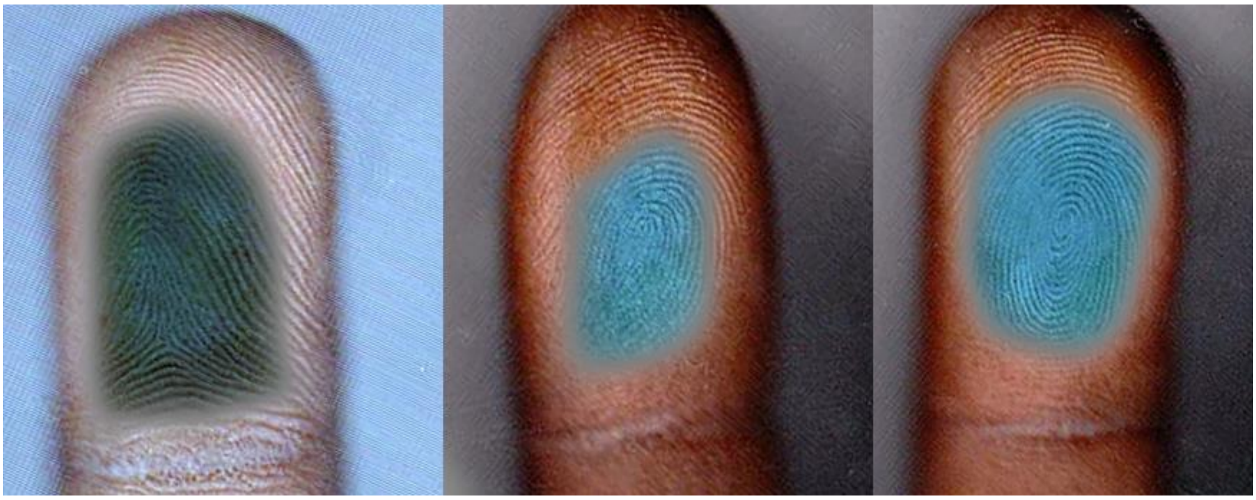
gentle; at other times it swings more sharply so that it may also be designated as a low or high arch respectively. The arch pattern is subdivided into two types:

Fig 4: Finger print pattern showing arch, loop and whorl respectively



a) Simple or plain arch composed of ridges that cross the fingertip from one side to the other without recurving.
b) Tented arch composed of ridges that meet at a point so that their smooth sweep is interrupted.

ii) Loops: It is the most common pattern on the fingertip. A series of ridges enter the pattern area on one side of the digit, recurve abruptly, and leave the pattern area on the same side. The loop pattern is subdivided into two types:

a) Ulnar loop composed of ridges that open on the ulnar side.
b) Radial loop composed of ridges that open on the radial side.

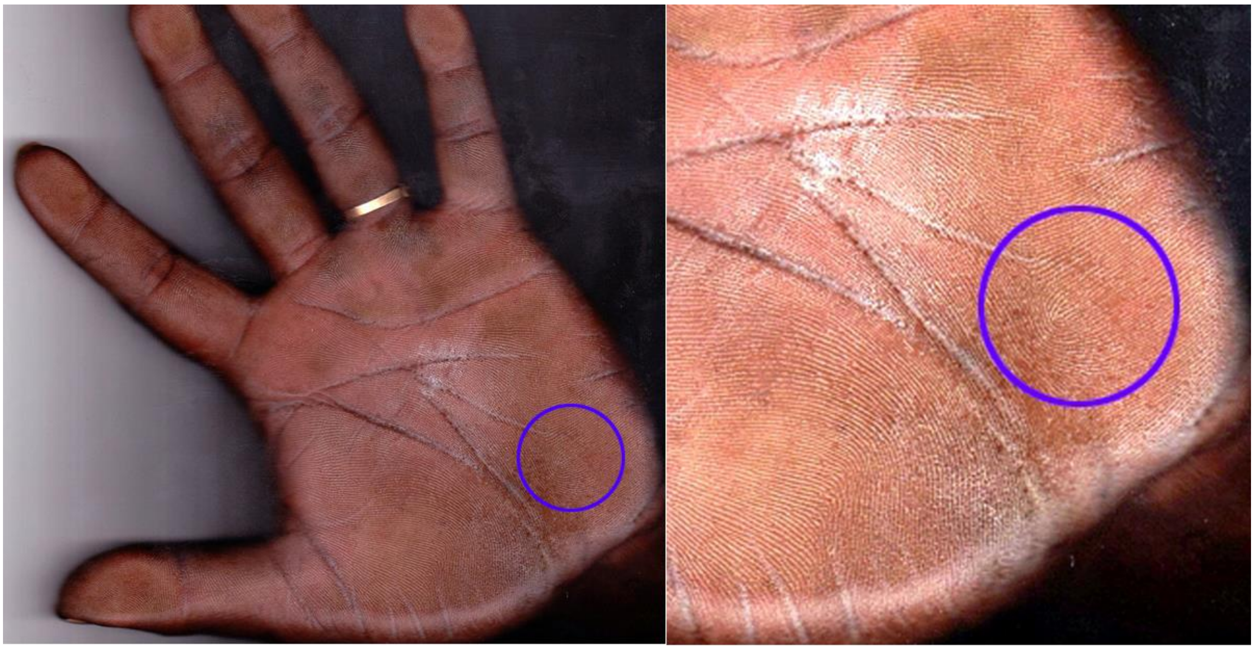
iii) Whorls: It is any ridge configuration with two or more tri-radii. One tri-radius is on radial and the other on the ulnar side of the pattern. Subtypes of whorl patterns include:

a) Plain/simple/concentric whorl composed of ridges that are commonly arranged as a succession of concentric rings or ellipses.
b) Spiral whorl is a configuration in which ridges spiral around the core in either a clockwise or a counter clockwise direction.
c) Central pocket whorl is a pattern containing a loop within which a smaller whorl is located. Central pockets are classified as ulnar or radial according to the side on which the outer loop opens.
d) Lateral pocket/twinned loop pattern is composed of interlocking loops.
e) Accidentals/complex patterns are one in which patterns cannot be classified as one of the above patterns.

Palmar patterns

The palm has been divided into several anatomically designed areas and includes thenar areas; four inter-digital areas, and the hypothenar area (Figure 5).

Fig 5: Hypothenar pattern



Hypothenar area: Patterns commonly seen are whorls, loops and tented arches.

After qualitative and quantitative analyses were done on the PD patterns of both the hands the obtained data were calculated and subjected to statistical analysis, and the results obtained were compared between group I and group II.

Statistical analysis:

Statistical analyses were presented in table 1-4.

Table 1: **Finger ridge patterns among the study groups- One way ANOVA**

Pattern	Group I		Group II		Oneway ANOVA	significance
	Frequency	Percent %	Frequency	Percent %	(F)	P value
Arches	17	5.67	50	11.17	2.800	.108
Loops	176	58.67	122	49.7	4.621	.036
Whorls	107	35.66	128	39.22	1.883	.176

Table 2: Hypothenar pattern among the study groups- Fischer exact test

Hypothenar Pattern	Group I Frequency (%)	Group II Frequency (%)	Significance
Yes	48 (63.3%)	6 (10%)	0.000
No	22 (36.7%)	54 (90%)	

Table 3: ATD angle among the study groups- Independent t test

Group I		Group II		t	p value
Mean (SD)	Min-Max	Mean (SD)	Min-Max		
39.29 (3.04)	33-45	44.97 (2.53)	40-49	7.866	0.000

Table 4: Mean AB ridge count among the study groups- Independent t test

Group I		Group II		t	p value
Mean (SD)	Min-Max	Mean (SD)	Min-Max		
39.40 (2.82)	35-47	41.30 (2.9)	35-48	2.538	0.014

RESULTS

Statistical analysis was done for both qualitative and quantitative variables. One way ANOVA [Table 1] was done for analyzing the finger ridge pattern among the 2 study groups, and the result was found to be statistically significant for loops (p = 0.036). Fischer exact test [Table 2] was done for analyzing the hypothenar pattern, and the result was found to be statistically significant among 2 study groups ($p < 0.000$). Independent t test [Table 3&4] was done for ATD angle and AB ridge count among the 2 study groups and result was found to be statistically significant ($p< 0.000$ and $p<0.014$).

DISCUSSION

Cancers of the oral cavity and pharynx contribute to nearly 4,00,000 new cases each year worldwide, more than half of which occur in India. Each year over 200,000 die of the disease, and over a third of these deaths occur in India.[10]

Tobacco use and alcohol consumption are the key established risk factors for premalignant disorder (PMD) and oral cancer. Of all the individuals who use tobacco only few are susceptible to PMD and oral cancer. These variations in the occurrence of the condition with the habit of smoking could be related to the genetic susceptibility of the individual. This genetic determination could also be related to the dermatoplyphic pattern which is also genetically determined and least changed by the environment. These patterns are unique for every individual and even it is dissimilar in monozygotic twins.

Genome-wide association studies (GWAS) have successfully identified disease susceptibility loci to various complex diseases.[11]

Dr. Harold Cummins in 1936 has proved certain unique consistent dermatoglyphic changes in several children with trisomy 21 (Down's syndrome) that were absent among controls. This earth-shattering discovery helped to move the budding science of dermatoglyphics from a place of obscurity to being acceptable as a diagnostic tool among medical personnel. Since then widespread interest in epidermal ridges developed in medical field since it became apparent that many patients with chromosomal aberrations had unusual ridge formations. Inspection of skin ridges, therefore seemed promising, simple, inexpensive means for determining whether a given patient had a particular chromosomal defect.[12]

It is suggested that many genes which take part in the control of finger and palmar dermatoglyphic development can also give indication to the development of premalignancy and malignancy[13] hence identifying persons at high risk for oral leukoplakia could be of great value to decrease the incidence of the future risk of oral cancer.

Considering the high mortality and high morbidity rate due to oral cancer in India, we planned to assess PD in oral leukoplakia and find whether a correlation exists between oral leukoplakia, and PD.

The finger ridge patterns were observed to find the pattern predominance, and the results were statistically analyzed by One-way ANOVA. It was found that the whorls pattern were predominant in controls (39.22%) when compared with the OL (35.66%). Loops were more predominant in OL (58.67%) when compared with controls (49.7%) ($p = 0.036$).

The hypothenar patterns were almost absent in the controls (10%) and is present in the OL (63.3%) with a very significant p value ($p = 0.000$).

The mean ATD angle in the group II was 44.97° with a standard deviation of ±2.53, and in OL, the ATD angle was less than 40° with the standard deviation of ±3.04. The ATD angle is reduced in OL due to farther position of 't' triradii in these patients.

The AB ridge count in the group II was 41.30 with a standard deviation of ±2.538 and in the patients with OL the AB ridge count was 39.40 with a standard deviation of ± 2.82. The frequency of AB ridge count in the OL was slightly decreased in comparison with the group II.

To conclude, our study confirms that there is a qualitative and quantitative variation in the PD between OL and patients without lesions. There is predominance of loop pattern with reduced ATD angle, AB ridge count and increased prevalence of pattern in the hypothenar area, where as in patient with no lesions whorls were predominant with increased AB ridge count and ATD angle and decreased prevalance of hypothenar pattern.

Limitation:

Although there exists a unique pattern in the OL patients it could not be solely attributed to OL alone as there might be other dental conditions such as dental caries, periodontal problems, bruxisism which could alter the outcome.

CONCLUSION

Though there exists a lot of limitations of this PD studies this could be used as an effective tool in determining the high risk individuals, as it a non invasive and economic method. It can also be used as an education tool to motivate the patient to quit the habit early thus avoiding the future risk of cancer. Further the study has to be continued on a large scale to universalize the dermatoglyphic markers of OL which in turn can serve as a powerful screening tool for tobacco users.

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