

## Role of Dermatoglyphics In Malignant And Potentially Malignant Disorders of the oral Cavity: A Cross-Sectional Study

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### Abstract

**Introduction:** Palmar dermatoglyphics has been studied in many diseases and alterations in normal patterns have been noted which is genetically determined. Millions of people consume tobacco, but all of them do not suffer from potentially malignant disorders (PMDs) of the oral cavity like oral submucous fibrosis (OSMF) and oral leukoplakia (OL), and oral squamous cell carcinoma (OSCC). It seems likely that a genetic predisposition could be an underlying mechanism.

**Aims and Objectives:** The present study aims to compare the dermatoglyphic patterns of such patients, in patients without habits and in patients with habits but with no lesions.

**Materials and Methods:** Fingerprints and palm prints were studied in 180 patients of Bihar, who were randomly divided into three groups: (A) 60 subjects with OSMF, OL and OSCC, (B) 60 patients with habits and no lesions, and (C) 60 healthy controls, for the purpose of finding patterns that could identify patients with PMDs and OSCC. Finger and palm prints were taken by the ink method. Prints were analysed by two examiners.

**Results:** The results were tested for statistical significance. Weighted kappa statistics were used to evaluate the inter- and intra-observer agreement. It was observed that the arch pattern (60.7%) was pre-dominant with a decrease in whorl pattern (29.3%) in group A when compared with the controls (group B and C) and the difference was highly significant ( $P < 0.01$ ). The study group demonstrated an increase in the mean total finger ridge count as compared to the controls and the result was found to be highly significant ( $P < 0.02$ ). The kappa-value for interobserver agreement was 0.675 and for intraobserver agreement it was 0.747

**Keywords:** Dermatoglyphics, oral leukoplakia, oral squamous cell carcinoma, oral submucous fibrosis.

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### I. Introduction

Dermatoglyphics is a relatively new science, which involves the study of fine patterned dermal ridges on digits, palms and soles. Cummins and Midlo (1926) coined the term dermatoglyphics (derma = skin; glyphs = carvings), for the scientific study of ridges as well as the ridges themselves.[1] Since decades the patterns of hand have enthralled individuals from intellectuals to laymen. These patterns of the hand are no longer restricted to palmistry. Through constant effort by eminent researchers these patterns now play an important role in the diagnosis of several medical and genetic disorders. Dermatoglyphics is not a new science and was established by Galton in the year 1892. It was Cummins and Midlo who coined the term "Dermatoglyphics" in 1926, which is a branch of genetics dealing with the skin ridge system.[2]

Oral cancer is one of the leading causes of death due to tobacco, alcohol abuse and unhealthy lifestyles.[3] However, only a fraction of people exposed to these risk factors develop potentially malignant disorders (PMDs) and oral squamous cell carcinoma (OSCC). Genetically determined differences among these individuals would explain the susceptibility.[4] The dermal ridges are developed during the intrauterine life. Once formed, these patterns do not change throughout life and hence are used for personal identification.[2] The oral mucosa also differentiates during the same period. Dermatoglyphics has proved to be a valuable adjunct to other diagnostic methods in identifying specific syndromes of genetic origin.[5] Its role in the causation of PMDs and OSCC is still in its infancy. The present crosssectional study was therefore undertaken to compare the palmar dermatoglyphic pattern in patients with PMDs, OSCC and controls.

## II. Materials And Methods

Patients reporting to the dental outpatient department of Patna Dental College were selected for the study. The procedure was explained to the patients. Informed consent was obtained from them prior to obtaining the prints. It was explained to the patient, that the sole purpose of procuring the finger prints was for academic purpose, would not be misused and that the confidentiality would be maintained. The research group comprised 180 patients who were segregated into three groups, as mentioned below:

**Group A:** 60 patients with oral leukoplakia (OL), oral submucous fibrosis (OSMF) and OSCC.

**Group B:** 60 healthy patients with habits (such as tobacco smoking or chewing and consumption of alcohol) and no lesions.

**Group C:** 60 healthy patients without habits.

Patients aged between 20 and 65 years were selected for the study of which 82 were females and 98 were males. Group A included 24 females and 36 males. Group B included 26 females and 34 males. Group C included 32 females and 28 males. The study group A included clinically diagnosed cases of OSMF, OL and OSCC. A detailed history was recorded and after clinical examination the findings were recorded in a case history proforma and incisional biopsy was performed.

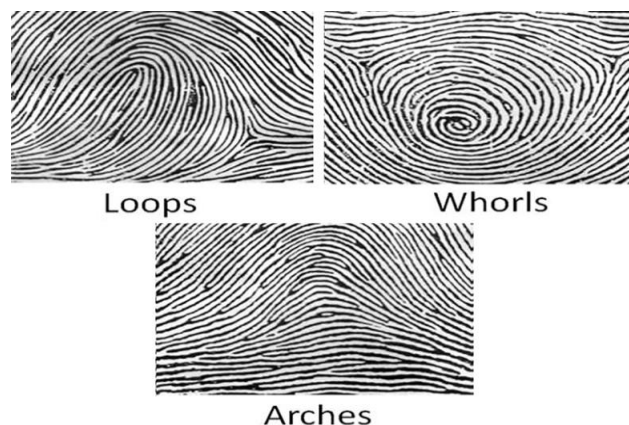
The lesions which were confirmed histopathologically were included in the study. The finger and palm prints of individuals with history of tobacco-related habits (smoking/smokeless), pan, betel nut chewing and alcohol consumption (Group A and B), and normal individuals of comparable age group and sex without tobacco-related habits (Group C) were taken for the study. Patients with other causes of oral lesions like cavities, sharp tooth irritation, dentures, etc., were excluded from the study. The finger and palm prints were obtained by the Ink method, as described by Cummins and Midlo. The armamentarium comprised Kore's duplicating ink, white paper, magnifying lens, protractor, scale and pencil [Figure 1]. Hands were thoroughly washed with soap before taking prints to remove soil, oil and dirt. Then requisite amount of ink was placed on the palms. The ink was evenly spread on the palms and fingers. To take the palm print, the palm was kept on white paper and firm pressure was given on the center of the dorsum of hand and interdigital areas. For finger prints they were placed on a white paper with one lateral edge and then rolled over in the opposite direction [Figure 2]. These dermatoglyphic patterns were then analysed with a magnifying lens. The patterns of the three groups were analysed by two examiners trained for analysing the dermatoglyphic patterns, who were blinded as to which group the patterns belonged to. The prints were re-analysed by the same examiners after a period of 1 month. The patterns were analysed both qualitatively and quantitatively.



**Figure 1:** Armamentarium for making palm and finger prints



**Figure 2:** Inked hand showing making of finger prints



**Figure 3:** Dermatoglyphic patterns seen on the fingers

**Qualitative analysis**

Fingertip print patterns were classified as arches, loops and whorls [Figure 3]. Patterns on all the 10 fingers in both hands were analyzed. In every subject, the frequency of each pattern was recorded and the percentage of pattern frequency was calculated for the entire group. Palmar patterns were observed in the hypothenar (Hy), thenar/interdigital 1 (Th/I<sub>1</sub>) area, and interdigital 2, 3 and 4 (I<sub>2,3,4</sub>) areas of the palms. Various patterns encountered in both hands were noted. The frequency of palmar patterns was calculated in both hands separately and a comparison was made between the study groups.

**Quantitative analysis**

**The following parameters were analysed on the palmar patterns:-**

- Total finger ridge count: Total finger ridge count was calculated for all 10 fingers, by taking its mean.
- ATD angle: On the palm generally there are four digital triradii in the distal portion. They are termed as a, b, c and d proceeding in the radio-ulnar direction. The axial triradius ‘t’ is found usually near the proximal palmar margin. The ATD angle is a dermatoglyphic trait formed by drawing lines between the triradii below the first and last digits and the most proximal triradius on the hypothenar region of the palm. ATD angles were measured in both hands.

The parameters were then analysed statistically. For qualitative analysis and quantitative analysis Chisquare test was applied. Odds ratio and positive predictive value were also calculated and were set at 95% confidence intervals. The inter- and intra-observer agreement was assessed by weighted kappa statistic. The analysis was performed using statistical package SPSS 10.01 version.

**III. Results**

In patients with OL, OSMF and OSCC (study group A) there was an increased frequency (60.7%) of arches, whereas in the control groups B and C, there was an increased frequency of loops and whorls (36.1% and 40.5%, respectively) with  $P < 0.001$ , which was statistically significant. Table 1 shows the frequency of various finger print patterns in all the three study groups. Odds ratio was 15.11% (95% confidence, interval 4.2-54.24%,  $P < 0.0001$ ).

**Table 1:** Frequency of finger ridge patterns in the three groups

Pattern	Group A (%)	Group B (%)	Group C (%)	Chi-square	P-value
Arches	68 (60.7)	12(10.7)	32 (28.6)	30.66	<0.001
Loops	360 (33.3)	390 (36.1)	330 (30.6)		
Whorls	172 (29.3)	178(30.3)	238 (40.5)		

Ratio 3.12 (95% confidence, interval 1.56-6.24%), and positive predictive value was 85% (95% confidence interval 70.15-94.25%). These values indicate that the finger print patterns are highly significant. The frequency of hypothenar pattern was more in group A (54.1%) on both hands but was not statistically significant ( $P = 0.969$ ). The distribution of thenar/ I<sub>1</sub>, I<sub>2</sub>, I<sub>3</sub> and I<sub>4</sub> patterns showed no significant difference among the three groups  $P > 0.005$  [Tables 2 and 3].

**Table 2:** Frequency of I<sub>1</sub> pattern in the three groups

Group A (%)	Group B (%)	Group C (%)	P-value
41.1	26.8	32.1	0.9867
39.5	27.9	32.6	
40.4	27.3	32.3	

**Table 3:** Frequency of I<sub>2</sub>, I<sub>3</sub> and I<sub>4</sub> pattern in the three groups

Group A (%)	Group B (%)	Group C (%)	P-value
33.3	40.0	26.7	0.7568
37.5	43.8	18.8	
35.5	41.9	22.6	

The distribution of total finger ridge count in all the three study groups showed that there is an increase in the total finger ridge count (64.7%) in patients with OL, OSMF and OSCC (group A). The frequency of mean ATD angles of both the right and left hands in all the three groups showed no statistical significant difference. The kappa-value for interobserver agreement was 0.675 and for intraobserver agreement was 0.747.

#### IV. Discussion

Oral cancer is one of the common malignancies occurring in the world. In the South-East Asia region, cancers of the mouth and oropharynx are the second leading cause of cancer deaths according to reports from the World Health Organization (WHO).[6] The considerable influence of lifestyle, habits such as the use of tobacco and alcohol, and the role of diet, on OSCC and PMDs are well recognized. Although several individuals with these habits do not develop cancer, there are individuals who develop OSCC in the absence of such habits or other etiological factors. Host susceptibility must therefore play a role. Hence for any disease, including OSCC, to occur interaction of lifestyle, environmental factors, and susceptibility is imperative.[7]

For example, one study of primary cancers among patients with tobacco-related malignancies, found a greater risk than would be anticipated if known risk factors such as tobacco use were constant.[8] Thus, susceptibility factors must play a role in at least some cases, but little attention has been paid to this. Because of the inability to metabolise carcinogens or pro-carcinogens and repair the DNA damage, some individuals appear to be more susceptible to cancer. Whereas there are a group of people who have an inborn error of repairing the DNA damage.[9] Therefore, there is a need to develop markers which are genetically determined. The dermatoglyphic patterns start developing by the sixth week of intrauterine life and their development is complete by 12th-13th week. At this time the genetic message is translated and thus influences the dermatoglyphic pattern. These ridge patterns are, therefore, genetically determined.[9] Once the finger prints are formed they do not change till death. Moreover, the differentiation of oral structures also occurs at the same time. Carter and Matsunga have postulated that abnormalities in dermal ridges can only appear when the combination of hereditary and environmental factors exceed a certain level.[11] Since the discovery of dermatoglyphics in 1926, it has been used in the study of several genetic abnormalities.[2]

The dermatoglyphic patterns of children with Down's syndrome were studied by Harold Cummins in 1936.[12] He elucidated consistent dermatoglyphic changes in these children as compared to controls. This breakthrough innovation advanced this art of dermatoglyphics from its nascent stage to being used as a marker in prediction of numerous medical disorders. Since most of the investigations required to confirm the diagnosis in hereditary disorders are complex and expensive, dermatoglyphics can be efficiently employed with other clinical signs as a screening procedure. It offers the advantage of being non-invasive, simple, and inexpensive without the need for specialized equipment or skills.

A genetic theory put forward by Herman M. Slats assumes that the basic finger print pattern sequence is all ulnar loops and that various genes cause deviations from this pattern sequence. It has been demonstrated by many that dermatoglyphics is of aid in the diagnosis and understanding the genetics of many human pathogenic abnormalities.[13] Cummins in 1936 pointed out characteristic differences in dermatoglyphic features in patients with Down's syndrome compared to the normal population. These were increase of ulnar loops which were vertically oriented and L-shaped, increased frequency of patterns in hypothenar area and significantly increased maximal ATD angles.[11] Adams and Niswander in 1967 observed an increased asymmetry of ATD angles in a group of patients with familial cleft lip with or without cleft palate.[14]

The different dermatoglyphic patterns are whorls, loops, arches and their subtypes. These patterns are present on the finger tips/buds, whereas the whole of the human palm shows certain other features such as ATD angle, thenar and hypothenar patterns, and t-triradius.[2] In the present study the palmar and finger prints were analysed quantitatively and qualitatively. Statistical analysis revealed increased frequency of arches in the study group A (60.7%) when compared to controls (groups B and C) which showed increased frequency of loops and

whorls (36.1% and 40.5%, respectively). The total finger ridge count (64.7%) was also significantly increased in group A as compared to the controls which is a new finding in our study. The kappa-values also showed that the analysis of dermatoglyphic patterns is fairly reproducible.

Very few studies have been carried out to assess the dermatoglyphic patterns in cancer patients. A study carried out on 201 Turkish cancer patients noted an increase in whorls and decrease in radial loops.[15] In another study a decreased ridge count in cancer patients was found.[16] Very few studies have been carried out in relation to oral cancer. Venkatesh *et al.* in 2008,[17] performed a study on palmar dermatoglyphics in patients with OL and OSCC. Their results are consistent with our study which also showed a significant increase in the frequency of arches in patients with OL and OSCC, but did not show an increase in the total finger ridge count as seen in our study. A study carried out by Gupta *et al.*[18] also showed promising results. In OSCC, there was an increase in frequency of arch and ulnar loop patterns on fingertips, decrease in frequency of simple whorl patterns on fingertips, and decrease in frequency of palmar accessory triradii on the right and left hands. Significant findings in OSF included an increase in frequency of arch and ulnar loop pattern, decrease in frequency of simple whorl patterns on fingertips, decrease in ATD angle on the right hand, and decrease in frequency of palmar accessory triradii on the right hand. A study by Tamgire *et al.*[19] showed a highly significant decrease in simple whorl pattern on the left little finger in OSMF.

While taking palm prints difference in the pressure applied could lead to misinterpretation of the patterns. Only two parameters were statistically significant and the small sample size could be a limitation of our study. Further studies have to be done with a larger sample size in order to evaluate the significance of these variations in the dermatoglyphic features in patients with PMDs and OSCC.

## V. Conclusion

The results of this study has further added to the existing importance of dermatoglyphics. As PMDs and OSCC have a genetic basis, with the knowledge of dermatoglyphic patterns, individuals who are prone to develop these lesions can avoid the trigger factors. The relevance of dermatoglyphics is not for diagnosis, but for prevention, by predicting a disease, and not for defining an existing disease, but for identification of people with the genetic predisposition to develop certain diseases.

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