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Evaluation of Prevalence of Fingerprint Patterns in Patients with Oral Potentially Malignant Disorders

Angel Subramanium
Christian Dental College, Ludhiana, Punjab, India

Tarun Koshy Isaac
Christian Dental College, Ludhiana, Punjab, India

Bhushan Sharma
Christian Dental College, Ludhiana, Punjab, India

Vivek Vardhan Gupta
Christian Dental College, Ludhiana, Punjab, India

Shekhar Kapoor
Christian Dental College, Ludhiana, Punjab, India

Neha Chitkara
Christian Dental College, Ludhiana, Punjab, India

***Abstract*---**Aim: This study was conducted to evaluate and compare the prevalence of dermatoglyphic patterns amongst patients diagnosed with OPMD and a control group consisting of patients with/without tobacco habit, to prevent the occurrence of disease in susceptible individuals. Materials and Methods: Fingerprints were recorded using the Ink Method by Cummins and Midlo, and were subjected to analysis and statistical evaluation. Results: Fingerprints of a total of 150 patients were recorded amongst which each group i.e. subjects with OPMD, control with habit and control without habit consisted of 50 individuals. There was an equal distribution of whorl and loop pattern whereas arch pattern was found to be significantly less in number overall. Conclusion: Dermatoglyphics can be used for predicting various genetic disorders, when compared to environmental disorders, which are less case specific. In the present study there is no prevalence of individual pattern and it was found to be statistically insignificant, owing to the limited sample size. Studies in the field of

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***Corresponding author**: Gupta, V. V.; Email: drvivekpcd@gmail.com*
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dermatoglyphics among OPMD patients' needs more research in order to draw recognizable and accountable conclusions.

***Keywords*---**dermatoglyphics, fingerprint pattern, malignant disorders, oral carcinoma, oral potentially, tobacco consumption.

Introduction

According to World Health Organization (WHO), 1 in 6 individual deaths occurs due to cancer. A low survival rate of 50% is seen among patients with oral cancer (1). Oral Potentially Malignant Disorders (OPMD) are specific indicators for malignancy and are further classified into premalignant lesions and premalignant conditions (2). Decades of studies have shown patients with OPMD usually being diagnosed at late stages leading to a decrease in survival rate, though the oral cavity is the most accessible site for clinical examination (3). Early detection could lead to a survival rate of 80-90% (4). There have been various tools used for the diagnosis of oral cancer among which biopsy isthe most definitive diagnostic tool which is also considered the gold standard (5). Various cytogenic markers might be used to predict the chance of occurrence of these diseases due to genetic predisposition. However, these are far more costly, invasive and complicated (6). Therefore, there is an ever-growing need of developing newer screening tools that can accurately detect oral cancer in the early stages (7).

Various dermatoglyphic studies have been done for genetically inherited diseases such as Down's Syndrome, Schizophrenia, Leukaemia, Diabetes, Hypertension, Epilepsy, Cleft lip and, Cleft palate to develop a preventive measure (8). As dermatoglyphics deals with the study of the epidermal ridges and their configurations on the fingers, palms, and soles, its scanning or recording permanent impressions is rapid, inexpensive, convenient, and does not cause any trauma to the patient or any need of hospitalization (9). Former studies have concluded dermatoglyphics as a screening tool for early detection of OPMD (10). Hence dermatoglyphics play an important role in prevention by segregating those individuals who are at an increased risk for developing OPMD (6).Various studies have been previously done in different parts of India but none so far have been carried out in the state of Punjab (11,12). This study was conducted in the state of Punjab using the methodology of dermatoglyphics in patients with OPMD and was compared with the general population with same habits.

Materials and Method

A non-interventional case-control study was conducted amongst the population of Ludhiana district of Punjab after obtaining clearance from Institutional Ethical Committee. In reference to the previous literature (5) the minimum sample size for each group was calculated using the two mean sample estimation method. Assuming equal group sizes to achieve a power of 80% and a two-sided confidence level of 95%, a non-response rate of 5%, the minimum required sample size was 50 per group. A total number of 150 individuals were selected from the Department of Oral Medicine and Radiology Christian Dental College, Ludhiana. The individuals were divided into groups as follows:

- Patients diagnosed with OPMDwith/ without history of tobacco consumption
- Control group with history of tobacco consumption
- Control group without history of tobacco consumption

Selection criteria

- Inclusion Criteria for Group A-
  - Subjects diagnosed with active OPMD.(13)
  - Subjects should be within the age group of 20-80 years.
  - Subjects willing to participate in the study.
- Exclusion Criteria for Group A-
  - Subjects with injuries on the recording finger.
  - Subjects with history of sharp tooth margins, improper restorations, prosthesis.
  - Subjects associated with any other systemic disease.
- Inclusion Criteria for Group C & D -
  - Should be within the age group of 20-80 years.
  - Should be willing to participate in the study.
- Exclusion Criteria for Group C & D -
  - Subjects with injuries on the recording finger.
  - Subjects associated with any other systemic disease.

Materials required

- Blue duplicating ink (Premier Stamp Pad – Violet Ink)
- White bond non-blotting paper (Neelgagan A6 size)
- Stereo Microscope (GOKO MIAMB MZ-DIGI)
- Soap (Bufin Soap Strips), Water, and paper towel (Orange Serviettes by SS India Corporation).
- Hand sanitizer (BiocheckHandrub)

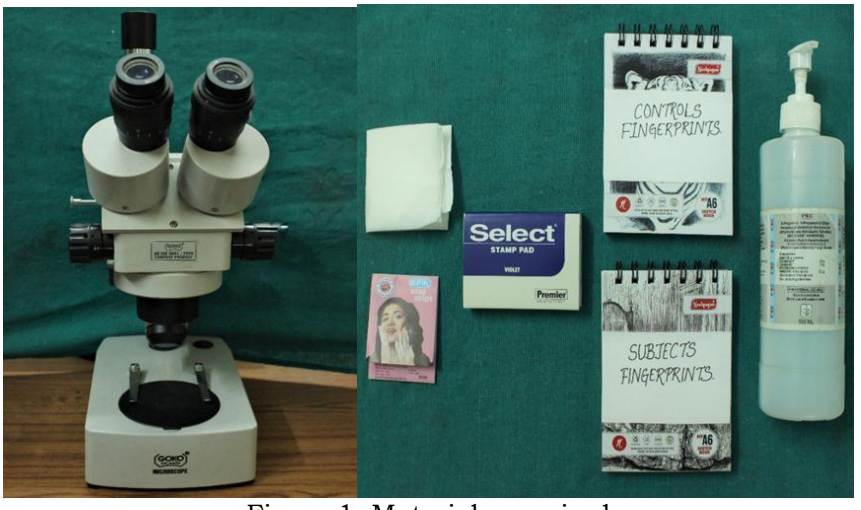

Figure 1. Materials required

Methods

Dermatoglyphic patterns in this study were recorded using 'The Ink Method' by Cummins and Midlo (14). Patients were informed in detail about the study and their informed consent was obtained in the preferred language to conduct the study. To enhance the visibility of duplicated fingerprints, subjects were asked to wash their hands with soap and water before recording the fingerprints to remove any dirt, oil, or stain from the desired finger (15). The ink was applied uniformly over the desired finger and an impression was made on the white bond non-blotting paper. The fingerprints made were subjected to analysis (5).

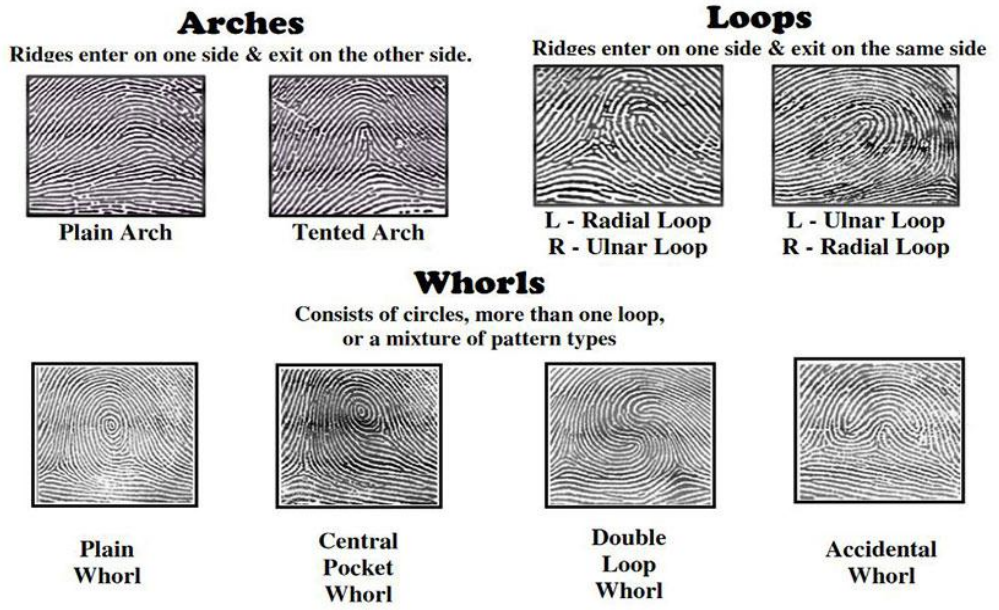

Figure 2. Fingerprints

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations were calculated. Statistical test applied for the analysis was Pearson Chi-square test. The level of confidence interval and p-value were set at 95% and 5%.

Results

A total data of 150 patients were recorded of which 50 consisted of patients with Oral Potentially Malignant Disorders (OPMD), 50 consisted of patients with habits without OPMD and 50 consisted of patients without habits and without OPMD after considering the inclusion and exclusion criteria. The age distribution of the collected data ranged from a minimum of 20 year old patient to a maximum of 74 year old patient with a mean age of 39.27 and standard deviation of 13.35 years.

Table 1
Gender distribution according to the presence of lesion and habit

	Group			
Gender	With Lesion	With Habit	Without Habit	Total
Female	14	7	18	39
	28.0%	14.0%	36.0%	26.0%
Male	36	43	32	111
	72.0%	86.0%	64.0%	74.0%
Total	50	50	50	150
	100.0%	100.0%	100.0%	100.0%

Test applied: Chi-Square Test

Table 1 describes the distribution of males and females according to the group distribution and the results were found to be statistically significant with a p-value of 0.40.

Table 2
Various patterns distributed according to gender

Gender	Pattern			Total
	Arch	Loop	Whorl	
Female	5	17	17	39
	25.0%	27.9%	24.6%	26.0%
Male	15	44	52	111
	75.0%	72.1%	75.4%	74.0%
Total	20	61	69	150
	100.0%	100.0%	100.0%	100.0%

Test applied: Chi-Square Test

When the dermatoglyphic patterns were observed as explained in table 2 among the genders, it was found that females had an equal number of loop and whorl patterns while males had slightly more whorl patterns. However arch pattern was seen in the least number in both the genders. The result was found to be insignificant with a p-value of 0.910.

Table 3
Pattern seen in each group

Pattern	Group			Total
	With Lesion	With Habit	Without Habit	
Arch	5	6	9	20
	10.0%	12.0%	18.0%	13.3%

Loop	20	22	19	61
	40.0%	44.0%	38.0%	40.7%
Whorl	25	22	22	69
	50.0%	44.0%	44.0%	46.0%
Total	50	50	50	150

Test applied: Chi-Square Test

It was noted as reported in table 3 that the Arch pattern was generally seenfewer in number irrespective of the group, whereas loop and whorl patterns had an almost equal distribution within the groups. The results were found to be insignificant with a p-value of 0.774. It was also seen that 10 among the 50 lesions were on some form of tobacco habits.

Table 4
Distribution of pattern seen in various OPMD

Oral Potentially Malignant Disorder	Pattern			
	Arch	Loop	Whorl	Total
Leukoplakia	0 0.0%	4 6.6%	4 5.8%	8 5.3%
Lichen Planus	4 20.0%	14 23.0%	10 14.5%	28 18.7%
Oral Submucous Fibrosis	1 5.0%	2 3.3%	11 15.9%	14 9.3%
Total	5	20	25	50
	25.0%	32.7%	36.2%	

The classification of OPMD as observed according to the pattern,displayed in table 4 revealed OSMF patients having the whorl pattern in the majority while the others had an almost equal distribution and the arch pattern was seen to be absent in patients with Leukoplakia.

Discussion

Dermatoglyphics is the branch of science which deals with the skin-ridge system and was established by Galton in the year 1892 (14). However,Jan Evangelista was the first person who studied the papillary ridges of hands and feet in the year 1823 (16). The term dermatoglyphics was coined by anatomist Harold Cummins in 1926 which was derived from two Greek words (derma-skin and glyphe-carve) (9,17). The study of dermatoglyphics has previously proved to be an important diagnostic tool for diseases with unclear etiology and vague pathogenesis (6). The science of fingerprints is extremely complex and is still in the process of decoding (18). Literature states co-relation of dermatoglyphics with diseases like diabetes mellitus, cleft lip, and palate, hereditary gingival fibromatosis, periodontal disease, dental caries, dental malocclusion,hypertension, pulmonary tuberculosis,

and schizophrenia (11,18). Studies have also been conducted to understand the association of genes developing the fingerprint pattern and transformation of oral potentially malignant disorders to oral carcinoma (8).

When the global outlook is kept under consideration, oral cancer holds the fifth rank among carcinoma in-situ (19). While bringing the five-year survival rate into consideration, it is statistically noted that even with surgery, radiation, and chemotherapy it has not improved in the past decades and has remained constant at 50-55% (3,5). Therefore, equal emphasis should be given to disseminating knowledge about the disease to the general public along with early clinical detection. Lower survival statistics can also be attributed to delay in the identification and recognition of questionable lesions contributing to diagnosis at an advanced stage (3). Although various diagnostic techniques are being used such as supravital staining, oral cytology, and optical technologies comprising of spectroscopy, fluorescence spectroscopy, elastic scattering (reflectance) spectroscopy, Raman spectroscopy, fluorescence imaging, optical coherence tomography, narrow-band imaging, and multimodal optical imaging (13) the difficulty faced with the abnormalities resulting from the amalgamation of environmental and hereditary factors remain the same since they appear only after exceeding certain level (9).

The investigations used to confirm genetic disorders are not just expensive but are also very complex. Therefore, authors have suggested using dermatoglyphics as a screening tool in conjunction with clinical signs (17). It offers an edge over conventional techniques by being simple, inexpensive, non-invasive, and least technique sensitive (6). The ink method, transparent adhesive tape method, photographic method, and Faurot method are few of the approaches to recording the fingerprint patterns (16). As postulated by Sir Francis Galton, fingerprints are permanent and cannot be changed during one's lifetime and as also stated by Cherrill FR, fingerprints do not alter the severity of the disease butrather remains immutable throughout the lifetime (19). The term potentially malignant disordersimply that not all the lesions described under this term transform to malignancy but only a few with morphological alterations display the potential of malignant transformation (2). Leukoplakia/erythroplakia, Oral submucous fibrosis, lichen planus, discoid lupus erythematosus, and palatal lesions in reverse smoking are classified under this term (20). However oral leukoplakia, oral submucous fibrosis, and lichen planus are the most common ones to be seen (13). Lethal carcinomas such as invasive oral squamous cell carcinoma are commonly led by these clinically identifiable premalignant alterations (3).

Literature states a persistent and well-established association of tobacco with oropharyngeal carcinoma (3). On the contrary, authors have also reported that not all patients with oral premalignant disorders with a history of tobacco consumption develop it (6,8,11,17). It has been proved that the host's genetic susceptibility plays an important role in such variations (6,8,17). This is a resultant of the interaction of lifestyle, environmental factors, cheek/lip/tongue biting, frictional keratosis developed by irritation from ill-fitting prosthesis or sharp cusp (5,17). Individuals with genetic instability and suppressed immunity when exposed to carcinogens prove to be high-risk individuals although without a history of tobacco consumption (17). The human papilloma virus has also been

seen to play a role in the etiopathogenesis of oral premalignant disorders as well as dysplastic and carcinomatous oral epithelium (13, 21).

The difference in the ratio of males and females has become remarkably less distinct across the globe over the past few years probably owing to the change in lifestyle and exposure (3). In India however,oral cancer ranks first for men and thirdfor women (19). In the present study also it was found that males were higher in number as compared to females despite that within each group the ratio did not have any significant difference. Leukoplakia and erythroplakia have been previously found to be dominant in the male gender (5,13,22). On the other hand, lichen planus was found to be present in females in a majority (13). The result is similar to the findings of the current study which also found females to be predominant in the lichen planus category and males in the category of leukoplakia. It has been observed that leukoplakia is predominant in the age group of 40-60 years while OSMF can be seen affecting younger individuals in the age group of 20-30 years which is consistent with the present study (5,13,22).

There is a disagreement when the prevalence of a single fingerprint pattern is kept in an account with OPMD. While some authors claim arch pattern to be more significant (6,11), there is a handful claiming it to be a loop pattern (8,19,23-25) and a few stating the prevalence of whorl pattern (15,17,26,27) in association with OPMD. However, it was observed in the present study that there was an insignificant difference among the pattern distribution which has also been reported by the study done by Tamigre et al. (28) owing to the majority presence of whorl and loop pattern among the general population.

Limitations and future prospects

In order to understand this complex science of dermatoglyphics and its association with oral premalignant disorders, it is suggested to conduct studies with the use of a larger sample size. The purpose of achieving statistically significant results can be obtained by age, sex, religion, and race matched controls with the subjects.

Conclusion

The relevance of dermatoglyphics was never for diagnosis rather was for screening and predicting disease, and not for defining an existing disease, but for identification of high-risk individuals with the genetic predisposition to develop certain diseases. However, there is a requirement of a lot of research to be done on the subject to have recognizable global outcomes.

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