Original Article

Detection of genetic predisposition in oral squamous cell carcinoma (OSCC) and oral submucous fibrosis patients by qualitative analysis of finger and palm-print patterns: A dermatoglyphic study

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ABSTRACT

Introduction: Oral squamous cell carcinoma (OSCC) is the sixth most common malignancy and is a major cause of cancer morbidity and mortality worldwide. Oral submucous fibrosis (OSMF) is a potentially malignant condition and it affects approximately 0.5% (5 million) people of the population in the Indian subcontinent. The present study has been undertaken to evaluate the genetic predisposition and frequency of specific finger and palm-print patterns in OSCC and OSMF patients by dermatoglyphic analysis. **Materials and Methods:** Fingerprints of 400 individuals were recorded with the help of korex duplicating ink consisting of 100 normal individuals without habit of chewing or smoking tobacco or betel nut, 100 normal individuals with habit, 100 OSCC patients, and 100 OSMF patients. **Result:** We found that whorl type of fingerprint pattern was predominant in significantly higher number of individuals of OSCC and OSMF group than in control groups, whereas individuals of both the control groups showed loop as a predominant fingerprint pattern. This indicates that the predominance of whorl type of fingerprint pattern would serve as a candidate screening marker for susceptibility to oral squamous cell carcinoma and oral submucous fibrosis in general population with or without tobacco chewing habit.

Key words: Dermatoglyphics, fingerprints, oral squamous cell carcinoma, oral submucous fibrosis

INTRODUCTION

With an ever increasing population it is important that methods be developed to identify individuals who are either at risk or already have a given illness in the most cost-efficient manner without sacrificing quality of care. The use of dermatoglyphics is a rather unique approach and cost effective for identification in such individuals.

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Dermatoglyphics is relatively a 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; glyphos-carvings) for the scientific study of ridge patterns.[1]

Dr. Harold Cummins, in 1936, examined several children with trisomy 21 (Down's syndrome) and found consistent dermatoglyphic changes that were absent among controls.[2,3] Dermatoglyphics is considered as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies.[4,5]

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.

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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,[6] hence identifying high-risk people for oral cancer and precancer could be of great value to decrease the incidence of the same.

Oral cancer, being most common cancer in India has etiological factors like tobacco, alcohol, viral, dietary, and genetic factors. Genetically determined susceptibility to external carcinogen may be important in the etiology of squamous cell carcinoma, as many persons though exposed to tobacco and alcohol does not develop oral cancer and vice versa.

Oral submucous fibrosis is a potentially malignant condition of oral cavity. There is a rise in prevalence of this disease in India. This is because the habit of betel nut chewing in the form of gutkha, kharra, etc., is becoming rampant which is one of the important risk factor for oral submucous fibrosis (OSMF). Its rate of malignant transformation is 7.6%.[4,7]

It is stated that individuals who are genetically predisposed to OSMF are susceptible to the condition.[8]

Considering the high mortality and morbidity due to oral cancer in India and high incidence of oral submucous fibrosis, this study was undertaken to analyze the dermatoglyphic patterns in these diseases. However, the present study was conducted to evaluate the qualitative analysis of finger and palm-print pattern of histopathologically diagnosed oral squamous cell carcinoma (OSCC) patients, clinically diagnosed OSMF patients, and normal individuals in the control groups with and without habit of tobacco/betel nut chewing and smoking, with the aim to observe the degree of divergence in these four groups and predominance of the specific dermatoglyphic pattern in the study group, if any.

MATERIALS AND METHODS

Selection of cases and controls

Total 200 newly diagnosed, previously untreated patients with OSCC (n=100) and OSMF (n=100)) from the Department of Oral and Maxillofacial Pathology, Government Dental College and Hospital at Nagpur, India were recruited between May 2011 to August 2012. The diagnosis of OSCC was confirmed by histopathological examination and OSMF by clinical examination. Two hundred control subjects were selected from people who reported hospital for routine dental check up. These control group subjects were divided into two groups as normal healthy individuals without habit of chewing/smoking tobacco or betel nut (n = 100) and normal healthy individuals with chewing/smoking tobacco or betel nut (n = 100). Patients with any developmental disturbances involving hands, syndromes, infections, mucocutaneous lesions, trauma, scar formation, systemic diseases, etc., were excluded. All subjects were ethnically homogenous Indians and from the same region of India. All enrolled subjects were consented and were investigated by author with designed standard protocol that involved history, clinical, and histopathological examination. The study was approved by Research and Ethics Committees of Maharashtra University of Health Sciences (MUHS), Nashik.

An ink method was adopted for printing finger and palm for which printers duplicating ink from Kores, a rubber roller, vitrified tile, and A 4 size white paper were used. The patients and controls were asked to wash their hands with soap and water, so as to remove any oil or dirt. A small quantity of ink was placed over the vitrified tile and spread with the help of roller and then applied over the fingers and palm uniformly. The finger ridges were printed starting from thumb to little finger in the same order. The fingertips were rolled manually to ensure the full prints of the ridges. Palm prints were also recorded.

Method of counting

The various patterns present on fingertips were analyzed according to the standard guidelines for classification given by Francis Galton (1982).[9] These are classified as arches [Figure 1], loops [Figure 2], and whorl [Figure 3]. In the palmar areas, presence or absence of various patterns were analyzed according to the guidelines given by Penrose and Loesch (1970).[4] Palm is divided into five areas I_1 (Thenar area), I_2, I_3, I_4, and I_5 (Hypothenar area) [Figure 4].

Statistical analysis

All the recorded finger and palm prints were analyzed by three observers to whom all the dermatoglyphic patterns were explained in detail. Then findings of each observer were compared. The results showed the comparable findings for all the three observers.

The data obtained after analyzing the finger and palm prints of control groups and study groups was entered in Microsoft excel sheet for counting and was subjected for statistical analysis. Using statistical software STATA version 10.0 Chi-square test was applied and P value for each variable was determined.

RESULTS

Whorls were the predominant fingerprint pattern in majority of OSCC (51%) and OSMF (53%) patients, whereas loops were the predominant fingerprint pattern in majority of control group individuals (group I-60% and

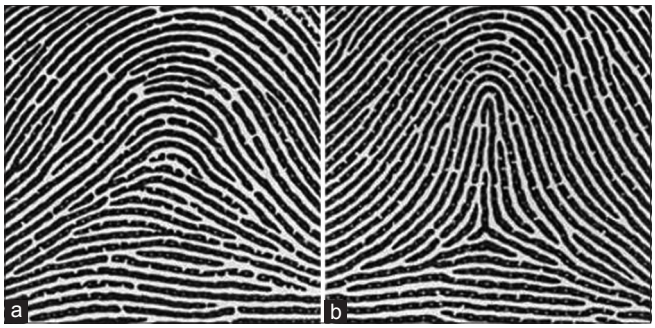

Figure 1: Types of arch (a) Plain arch (b) Tented arch

Figure 3: (a)Types of whorl Composite whorl, (b)True whorl, (c) Central pocket whorl

group II-68%). These differences were statistically highly significant. Arches were the predominant pattern in very few individuals in all the four groups ranging from 3-5% and therefore were statistically non-significant.

Presence of palm-print patterns in five palmar areas did not differ much between both the control groups, groups I, and group II and therefore was not statistically significant [Tables 1-4].

The frequency of different fingerprint patterns in two control groups were compared with OSSC cases (group III) and its statistical analysis was done.

A comparison of the frequency of different fingerprint patterns in two control groups was compared with OSMF (group IV) and subjected to statistical analysis.

DISCUSSION

Oral squamous cell carcinoma and oral submucous fibrosis are the disorders with genetic background. Very little work has been done on dermatoglyphic features in these diseases. So the present study was undertaken to determine an association between dermatoglyphic traits in OSCC and OSMF.

Figure 2: Loop

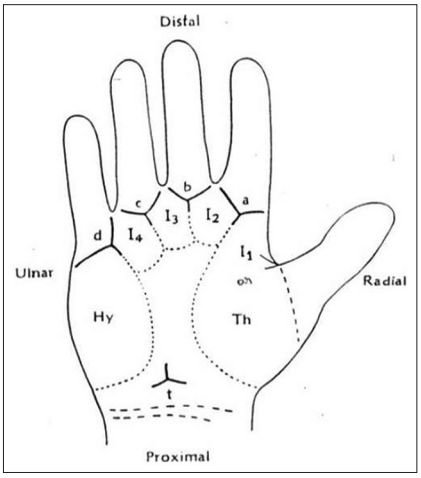

Figure 4: Five areas on palm

Galton F (1892) and Wilder HH (1902) were the first to study the hereditary basis of dermal patterns, suggesting that these ridge patterns are under genetic influence.[10] Gindilis and Finogenova (1976)[11,12] demonstrated that finger dermatoglyphic characteristics between identical (monozygotic) and fraternal (dizygotic) twins as well as between single sex parent-child pairs illustrate a high degree of genetic transmission. They calculated the heritability to be greater than 80%.

In the present study, it was observed that, in OSSC patients (group III) whorls were the predominant fingerprint pattern in majority of cases (51%) with high statistical significance, (*P* value 0.002) compared to group I (37%) and group II (27%). This was in accordance with SakinehAbbasi (2006)[13] who studied dermatoglyphics in 154 breast cancer patients and observed that in 48.6% of breast cancer patients, whorls were the predominant fingerprint pattern. Seltzer M.H (1982)[1,14], Chintamani *et al.* (2007),[15,16] and J. Lavanya (2012)[17] also reported that six or more whorls were present in the total fingertip

Table 1: Frequency of fingerprint patterns in all the four groups

Predominant pattern	Group I (100 control cases without habit) (%)	Group II (100 control cases with habit) (%)	Group III (100 OSCC cases (%)	Group IV (100 OSMF cases) (%)
Whorls	37 (37)	27 (27)	51 (51)	53 (53)
Loops	60 (60)	68 (68)	46 (46)	43 (43)
Arches	3 (3)	5 (5)	3 (3)	(4)

OSCC: Oral squamous cell carcinoma, OSMF: Oral submucous fibrosis

Table 2: Frequency of palmar print pattern in all the four groups

Palmar area	Presence of palmar pattern (%)			
	Group I (100 control cases without habit)	Group II (100 control cases with habit)	Group III (100 OSCC cases)	Group IV (100 OSMF cases)
I_1 area (Thenar area)	8 (8)	6 (6)	9 (9)	4 (4)
I_2 area	10 (10)	9 (9)	11 (11)	13 (13)
I_3 area	46 (46)	44 (44)	52 (52)	54 (54)
I_4 area	61 (61)	62 (62)	69 (69)	64 (64)
I_5 area (Hypothenararea)	23 (23)	25 (25)	28 (28)	28 (28)

OSCC: Oral squamous cell carcinoma, OSMF: Oral submucous fibrosis

Table 3: Comparison of frequency of fingerprint patterns in group I, II, and III

Predominant pattern	Group I (100 cases without habit) (%)	Group II (100 cases with habit) (%)	Group III (100 OSCC cases) (%)	χ^2	*P*	
Whorls	37 (37)	27 (27)	51 (51)	12.29	0.002	S
Loops	60 (60)	68 (68)	46 (46)	10.18	0.006	S
Arches	3 (3)	5 (5)	3 (3)	0.755	0.686	NS

OSCC: Oral squamous cell carcinoma. The frequency of different fingerprint patterns in two control groups were compared with OSSC cases (group III) and its statistical analysis was done

Table 4: Comparison of frequency of fingerprint patterns in group I, II, and IV

Predominant pattern	Group I (100 cases without habit) (%)	Group II (100 cases with habit) (%)	Group IV (100 OSMF cases) (%)	χ^2	*P*	
Whorls	37 (37)	27 (27)	53 (53)	14.459	0.001	S
Loops	60 (60)	68 (68)	43 (43)	13.30	0.001	S
Arches	3 (3)	5 (5)	4 (4)	0.520	0.932	NS

OSMF: Oral submucous fibrosis. A comparison of the frequency of different fingerprint patterns in two control groups was compared with OSMF (group IV) and subjected to statistical analysis

pattern (32.4%, 40.3%, and 53%, respectively) among breast cancer patients as compared to controls and the results were statistically significant. PolatHakan M(2004)[18] studied fingerprint pattern in 29 oral cancer patients and found the increased frequency of arches compared to normal individuals. However in this study, in very few cases (3%) arches were found to be the predominant pattern in 100 cases of oral cancer.

Vaishali V. Inamdar (2006)[19] who reported that, there was an increase in frequency of whorls in 90 carcinoma cervix cases compared to 90 normal individuals.

Huang C.M (1997)[1,20] studied fingerprints of 570 breast cancer patients and stated that frequency of ulnar loops on the left hand was significantly elevated for premenopausal women with breast cancer, whereas an excess of radial loops on the left hand was observed for the postmenopausal women with breast cancer.

In a dermatoglyphic study on breast cancer, Sakineh Abbasi (2006)[14] also reported that out of 308 normal individuals, whorls were predominant only in 27.5% of individuals.

G.S. Olad ipo (2009)[21] studied dermatoglyphics in 30 prostate cancer patients and compared it with same number of controls and found no significant differences in whorls, loops, and arches.

Kleisbauer JP (1980)[22] studied dermatoglyphics in 37 bronchial carcinomas and 51 lung diseases. The differences between lung carcinoma and controls were highly significant ($P < 0.01$) for the whorls and slightly significant ($P < 0.05$) for the ulnar loops, the other fingerprints (arch, radial loops) were quite similar in the two groups.

OSMF patients (group IV) also showed whorls to be the predominant fingerprint pattern in majority of cases (53%)

compared to group I (37%) and group II (27%) with high statistical significance (*P* value 0.001). However, Veena H. S. (2006)[23] who studied dermatoglyphics among 150 individuals (50 normal individuals without gutkha chewing habit, 50 normal individuals with gutkha chewing habit, and 50 OSMF patients with gutkha chewing habit), observed that there was decrease in frequency of whorls in OSMF patients.

Loops were the predominant pattern in majority of cases in both the control groups (60% in group I and 68% in group II) but in only 46% in OSCC group and only (43%) of OSMF, loops were the predominant pattern with high statistical significance.

PolatHakan M (2004)[18] studied fingerprint pattern in 29 oral cancer patients and found increased frequency of arches compared to normal individuals. However, in this study, in very few cases (3% in OSCC and 4% in OSMF) arches were found to be the predominant pattern in 100 cases of oral cancer. This difference would probably because of disparity in the sample size.

Kleisbauer JP (1980)[22] studied dermatoglyphics in 37 bronchial carcinomas and 51 lung diseases. The differences between lung carcinoma and controls were highly significant (*P* value less than 0.01) for the whorls and slightly significant (*P* less than 0,05) for the ulnar loops, the other fingerprints (arch, radial loops) were quite similar in the two groups. Sant SM *et al.*(1980)[10,24] studied dermatoglyphic traits in diabetic patients and observed that there was increased frequency of whorls and decreased frequency of ulnar loop in diabetic patients compared to control group. Hassan Solhi (2010)[25] studied dermatoglyphics in beta thalassemia patients and found the whorl type of fingerprint patterns to be significantly present than in normal individuals. Metin Atasu (1992)[1,25] studied dermatoglyphic configurations in caries-free students and the students with extensive caries and found that, caries free students had more ulnar loops on the fingertips, and the students with extensive caries had more whorls on the fingertips.

In OSSC and OSMF patients the number of individuals showing presence of palmar patterns were definitely on higher side in all the five areas (except I_1 area in OSMF) in comparison to both the control groups. Statistically significant differences might be achieved with a larger sample size. This is not in accordance with Polat M. Hakan (2004)[18] from the Istanbul University at Turkey, who studied dermatoglyphics in 29 oral cancers patients in which he observed that there was reduced frequency of patterns in 4th interdigital area in OSSC patients compared to control group.

The dermatoglyphic patterns may be utilized effectively to study the genetic basis of oral cancer and oral submucous fibrosis. In developing country like India, it might prove to be non invasive, inexpensive, and effective tool for screening. These patterns may represent the genetic makeup of an individual and therefore their predisposition to certain diseases.

To conclude the whorl type of fingerprint pattern was predominantly present in significantly higher number of individuals of OSCC and OSMF than in both control, whereas individuals of both the control groups showed loop as a predominant fingerprint pattern. So the predominance of whorl type of fingerprint pattern would probably be served as a candidate screening marker for susceptibility to oral squamous cell carcinoma and oral submucous fibrosis in general population. Considering the expenses involved in conducting the analysis of chromosomes themselves, dermatoglyphics can prove to be an extremely useful tool for preliminary investigations.

Future extensive research and studies in this field have to be done in order to determine, ascertain, and to evaluate the significance of these variations in the dermatoglyphic features of patients with these diseases.

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