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RESEARCH ARTICLE

UNRAVELLING THE MYTH- DERMATOGLYPHICS IN ORAL POTENTIALLY MALIGNANT DISORDERS

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ABSTRACT

Introduction: Dermatoglyphics has been studied in many diseases for underlying genetic susceptibility. Most of the people are affected with potentially malignant disorders (PMDs) of the oral cavity like oral sub mucous fibrosis (OSMF), oral leukoplakia (OL), and lichen planus. It seems likely that a genetic predisposition could be an underlying mechanism.

Aim: The present study aims to determine the association between dermatoglyphics and occurrence of potentially malignant disorders.

Materials and methods: Finger prints and palm prints were studied on 40 subjects who were divided into four groups: Group 1 consisted of 10 patients without any evidence of oral lesions that served as controls. Group 2 had 10 patients with lichenplanus. In group 3, 10 patients with presence of oral submuocus fibrosis and group 4, 10 patients with leukoplakia were included. Finger and palm prints were taken by the ink method.

Results: Krusk-wallis test, Mann Whitney test was performed to compare finger print patterns and ATD angle between cases and controls. It was observed that the whorl patterns (47%) were predominant with a decrease in arch pattern (11%) in group 1when compared with the other case groups. The study group demonstrated decreased ATD angle as compared to the controls and the result was found to be highly significant ($P < 0.01$).

Conclusion: Dermatoglyphics can be implemented as a screening tool in patients with PMDs. It may act as an adjunct tool in screening patients who are at increased risk of developing potentially malignant disorders.

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INTRODUCTION

The occurrence of oral cancer is sustained to be mounting gradually in the recent scenario (George, 2011). Survival rate for an individual affected with cancer depends upon the stage at which it is diagnosed (Vander Waal, 2009). Oral potentially malignant disorders (OPMDs) include a variety of lesions and conditions characterized by an increased risk for malignant transformation (MT) to oral squamous cell carcinoma (OSCC) (Farah *et al*., 2014). Many researchers have declared that most of the oral cancers are preceded by potentially malignant disorders (Reibell, 2003). The common high-risk potentially malignant disorders are leukoplakia, oral submuocus fibrosis, erosive lichen planus in succession (Vander Waal, 2009). Vanderwal *et al* stated that if incidence of oral cancer is set at 5 per 1,00,00 population per year, then an annual risk of malignant transformation in oral leukoplakia patients is four hundred times the increased risk (Van der Waal, 2014). According to longitudinal study conducted by *Bombeccari etal* a seven year follow up study on 327 patients showed the annual malignant transformation of oral lichen planus accounted for less than 0.5% (Bombeccari *et al*., 2011). Oral sub mucous fibrosis, the other potentially malignant disorder which is addressed in present study has a malignant transformation rate of about 0.5-6% (Vander Waal, 2009) Many evidences suggest that the carcinogenic process is driven by an inherent genetic susceptibility. In response to environmental exposures, genetic damage accumulates more quickly in individuals having genetic susceptibility to DNA damage than people without such instability, but with a similar exposure (Cloos *et al*., 1996; Chorlton, 1970). Consequently, individuals with genetic instability may be at a greater risk of developing these potentially malignant disorder (Lakshmana *et*

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al., 2017). Certain genetic markers might help in determination and forecasting occurrence of diseases in the future**.** Dermatoglyphics is an emerging tool, used as a genetic marker in predicting the diseases or disorders currently (Kumar *et al*., 2014). Dermatoglyphics is the branch of science that deals with ridge patterns and grooves on finger tips, palms, soles and toes of feet (Blanka Schumann and Milton Alter, 1976). Dermatoglyphics are formed by 18^{th} -21^{st} week of intra uterine life and remain unchanged till the death of an individual (Devi *et al*., 2015). Formerly, dermatoglyphics were used in person- identification by law enforcement officials (Blanka Schumann and Milton Alter, 1976). Based upon individual uniqueness, several research studies have emerged in dermatoglyphics which are considered as a promising asset in determining occurrence of oral cancer and potentially malignant disorders (Kumar *et al*., 2014). The current study deals with potentially malignant disorders, dermatoglyphics and to assess the association of genetic susceptibility in individuals, associated with potentially malignant disorders.

MATERIALS AND METHODS

A cross-sectional observational study was carried out among the subjects reported to a Dental school in geographic west of Godavari delta region, Andhra Pradesh, India for oral and maxillofacial examination. Each subject was explained about the need for the study and intervention to be conducted on them. A written informed consent was obtained from each subject before enrolment into the current study. Ethical approval was obtained from the Institutional research ethical committee. Subjects of either sex were included in the study with age matched controls. Subjects who had agreed to participate and signed the terms of informed consent were included in the study. Dermatoglyphic analysis was conducted by obtaining fingerprints of both hands of the subjects. Total sample size of 40 subjects was included in the study. The study consisted of 4 groups. Group 1 consisted of 10 patients without any evidence of oral lesions that served as controls. Group 2 had 10 patients with lichenplanus. In group 3, 10 patients with presence of oral submuocus fibrosis (osmf) and group 4, 10 patients with leukoplakia were included. All the cases were confirmed by histopathological examination after taking informed consent from patient.

Inclusion criteria

- Patients diagnosed with oral lichen planus, oral leukoplakia and oral submucous fibrosis were included in the study.

Exclusion criteria

- Subjects with presence of oral lesions due to other causes like sharp tooth margins, improper restorations, prosthesis
- Subjects with scars or any injury to palms
- Presence of any systemic diseases.
- Subjects not willing to participate in the study were excluded from the study.

Palmar prints and finger prints were taken by using standard ink method as proposed by ***Strong***, using carbon paper (black) and, sponge roller (Figure 1) (Strong, 1979). After placing on the lubricated carbon paper, the palm was pressed edge down against the paper margin and it was rolled to the opposite edge. The thumb was placed with the ulnar edge down and it was rolled toward the body (Figure 2) (Strong, 1979). The other digits were placed with their radial edges down and they were rolled away from the body. While taking imprints of the palm, special attention was given to mark the zone of flexion creases at the wrist and at the ulnar margin, the flexion creases where the fingers join the palm, and at the central hollow of the palm (Gupta, 2013).Finger prints were taken individually in the provided column (Figure 3). The finger and palmar prints were analyzed qualitatively and quantitatively using *Cummins, Mildo* and *Penrose* method. Various parameters studied were finger print patterns and ATD angle. Fingertip print patterns were assessed by using magnifying glass and categorized into three types whorls, arches, and loops. In order to find out the frequency of fingertip print patterns in both hands, all ten fingers of an individual were considered together. Frequency of each pattern was recorded in each individual for the entire group. The values of the four groups were compared and statistical differences were calculated by using Krusk-wallis test and Mann Whitney test. Qualitative analysis was observed by measuring ATD angle encountered in both patterns. Triradius points formed by the convergence of three patterns of ridges is ATD angle.

Fig. 1. Armamentarium for making palm and finger prints

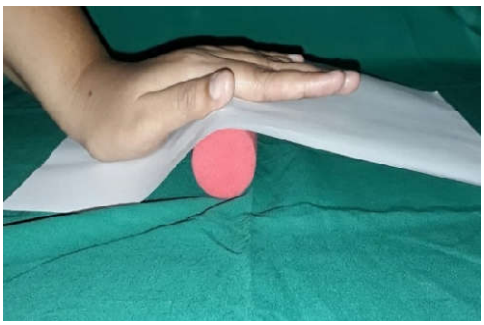


Fig. 2. Making of palmar and finger prints

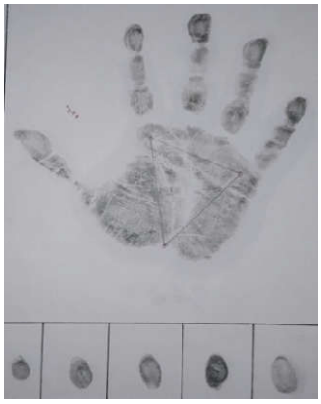


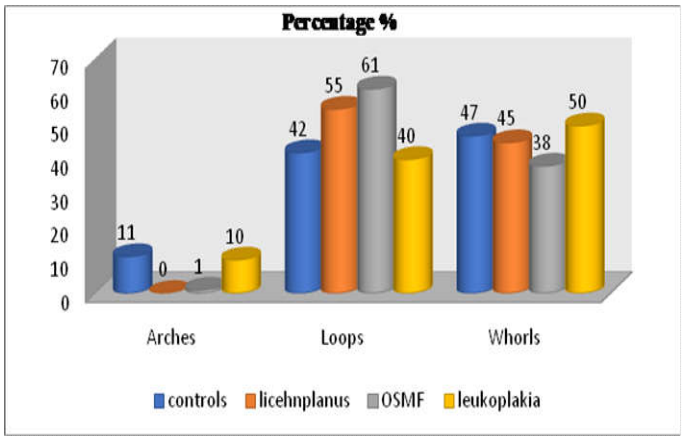
Fig. 3. Palmar and finger print of a subject with ATD
Point A -Triradii point present below the index finger.
Point T- Triradii point present in the thenar area
Point D-Triradii point present below the little finger. [15]

RESULTS

Descriptive statistics and correlation test were performed to determine the p-value for each variable. This included the analysis of mean, median and standard deviation which are presented in Table 1. Krusk-wallis test was done to analyse the finger ridge pattern and ATD angle in study groups and Mann Whitney test was performed to compare finger print patterns and ATD angle between cases and controls.

Qualitative analysis

Finger print patterns: The demographic data of the finger print patterns is described in the graph 1. There was significant increase in pattern of loops (49.5%) compared to other patterns among all groups with decrease in number in arches (5.5%) pattern.



Graph. 1. Demographic distribution of controls, lichen planus, oral submucous fibrosis, and leukoplakia

In group 1 (controls) highest frequency of whorl patterns (47%) was noticed with least frequency of arches (11%). In group 2 (lichen planus) highest frequency was seen among loop patterns (55%),which was similar with group 3(osmf) patients where highest frequency of loops distribution was noticed with mild difference of distribution between loop patterns of group 2 and group 3 in which the latter comprised of 61%.

Least distribution of arches was seen among lichen planus and OSMF with mean difference of 1%. In group 4 (leukoplakia) highest frequency of distribution noticed were whorls (50%) with least frequency of arches (10%). Among arches highest frequency seen in controls (50%) compared with other case groups. Highest frequency of Distribution of loops (30%) noticed in OSMF and least distribution in leukoplakia patients (20.20%). Leukoplakia patients had highest frequency of whorl patterns (27.77%) among all the groups and least whorl patterns noticed in OSMF group (Graph1). Analysis of the whorl finger patterns of right hand revealed increased mean among the lichen planus group patients in right hand, lowest mean in oral sub mucous fibrosis patients (Table 2). In analysis of whorl patterns of left hand, highest mean was noticed among the leukoplakia patients and least mean revealed in lichen planus patients but there was no statistical significance of whorl patterns in both the hands (Table 2). Arches pattern of right hand among cases where highest mean seen in leukoplakia patients absence of patterns among lichen planus and oral submucous fibrosis patients with high significance among all the case groups (Table 3). Arches pattern of left hand also shows highest mean in leukoplakia patients with least in lichen planus where as compared to the right hand, no significance was found (Table 3). Loops pattern of right hand showed highest mean in oral submucous fibrosis where as in left hand highest mean was noticed in lichen planus with no statistical significance in both the hands (Table 4).

Quantitative analysis

ATD angle of both right hand and left hand, which showed highest mean in lichen planus group in both right (39.3) and left hand (38.5) .Least ATD angle noticed in leukoplakia including right hand (34.8^0) and left hand (34.3^0) which were statistically significant (P<0.01) (Table 5).Highest mean of ATD angle noticed in left hand of controls (41.6^0) with statistical significance between cases and controls of both hands (Table 1).

DISCUSSION

Dermatoglyphics is a versatile scientific investigating implementation that is non-invasive, fast, and inexpensive (Shetty, 2016). It can be used as an effective genetic marker on the source that the epithelium of the primary palate, as well as finger buds are ectodermal in origin, develop from the same site during 6–13th week of intrauterine life (Sharma, 2009).

Table 1. Distribution of whorls arches, loops and ATD angle among study and control groups

Parameters		Mean	Median	SD	P-value	Inference
Whorls Right	Control	2.40	2.00	1.51	0.89	NS
	Case	2.27	2.00	1.55		
Whorls Left	Control	2.50	2.00	1.84	0.59	NS
	Case	2.20	3.00	1.56		
Arches Right	Control	0.60	0.50	0.70	0.10	NS
	Case	0.17	0.00	0.38		
Arches Left	Control	0.50	0.00	0.85	0.43	NS
	Case	0.20	0.00	0.55		
Loops Right	Control	2.10	2.50	1.52	0.47	NS
	Case	2.57	2.00	1.48		
Loops Left	Control	2.10	2.00	1.37	0.40	NS
	Case	2.63	2.00	1.54		
ATD Angle Right	Control	40.95	40.75	1.80	<0.01	HS
	Case	36.73	37.50	3.06		
ATD Angle Left	Control	41.26	41.00	2.40	<0.01	HS
	Case	35.98	36.00	3.11		

P value - < 0.01 –statistically significant, HS- highly significant, NS- non significant,
SD –standard deviation

Table 2. Comparison of whorl patterns on right and left hand among group 2, group 3 and 4(study groups)

WHORLS	Mean		Median		SD	
	R	L	R	L	R	L
Lichen planus	2.60	1.90	3.00	2.00	1.84	1.66
Oral sub mucous fibrosis	1.80	2.00	2.00	2.00	1.55	1.70
Leukoplakia	2.40	2.70	2.50	3.00	1.26	1.34
Chi-square=1.45 P-value=0.69	NS (right hand)					
Chi-square=1.65 P-value=0.65	NS (left hand)					

P value <0.01 statistically significant .NS-non significant, SD – Standard deviation
R-right hand L- left hand

Table 3. Comparison of arch patterns of right and left hand among group 2, group 3 and 4(study groups)

Arches	Mean		Median		SD	
	R	L	R	L	R	L
Lichen planus	0.00	0.00	0.00	0.00	0.00	0.00
Oral sub mucous fibrosis	0.00	0.10	0.00	0.00	0.00	0.32
Leukoplakia	0.50	0.50	0.50	0.00	0.53	0.85
Chi-square=12.92 P-value<0.01	HS (R)					
Chi-square=4.80 P-value=0.19	NS (L)					

NS- non significant .HS - highly significant, SD – Standard deviation R-right hand L- left hand

Table 4. Comparision of loop patterns of right and left hand among group 2, group 3 and 4(study groups)

Loops t	Mean		Median		SD	
	R	L	R	L	R	L
Lichen planus	2.40	3.10	2.00	3.00	1.84	1.66
Oral sub mucous fibrosis	3.10	3.00	3.00	3.00	1.45	1.70
Leukoplakia	2.20	1.80	2.00	2.00	1.03	0.92
Chi-square=2.53 P-value=0.47	NS (R)					
Chi-square=4.28 P-value=0.23	NS (L)					

NS- Non significant significant, SD – Standard deviation R-right hand L- left hand

Table 5. Comparison of ATD angle of right and left hand among group 2, group 3 and 4(study groups)

ATD Angle	Mean		Median		SD	
	R		R	L	R	L
Lichen planus	39.30	38.50	38.50	39.00	2.66	3.00
Oral sub mucous fibrosis	36.10	35.15	36.50	35.00	1.71	2.14
Leukoplakia	34.80	34.30	35.00	34.00	2.87	2.57
Chi-square=25.72 P-value<0.01	HS (R)					
Chi-square=24.15 P-value<0.01	HS (L)					

NS-non significant .HS - highly significant, SD – Standard deviation R-right hand L- left hand

Fingerprints are a multifactorial trait (Umraniya *et al*., 2013). A large number of genes interplay with environmental influences in forming these distinct fingerprints (Umraniya, 2013; Galton, 1892). The pattern remains unchanged throughout life except for an increase in size with general growth. Ramani *et al*. (1982) observed the genetic component for various fingertip patterns (Ramani *et al*., 2011). Once formed, they are age and environment stable, becoming a reliable indicator of a genetic damage (Padmini *et al*., 2011). At present, researchers claim that, the study of dermatoglyphics is an important diagnostic tool for some diseases, especially the ones with obscure etiology and mysterious pathogenesis (Tamgire *et al*., 2013). Substantial evidence suggests that the carcinogenic process is driven by an inherent genetic susceptibility (Lakshmana *et al*., 2017). In response to environmental exposures, genetic damage accumulates more quickly in individuals with genetic susceptibility to DNA damage than in those without such instability. Consequently, individuals with genetic instability might be at a greater risk for developing these lesions. The dermatoglyphic analysis is now beginning to prove itself as an extremely useful window for diagnosing conditions with a suspected genetic basis (Lakshmana *et al*., 2017; Wu *et al*., 002).

Various epidemiological studies support the fact that genetic alterations may be involved in pathogenesis of potentially malignant disorder. These antenatal disturbances can alter the epithelium to make it susceptible to various carcinogens (Gupta *et al*., 2013). The present study was carried out assuming the hypothesis that any such antenatal disturbance, if responsible for a disorder, should manifest in a prenatal event such as dermal ridge formation. In present study there was increase in frequency of loops among oral submucous fibrosis in resemblance with study, *Lakshman et al* and *Gupta et al* among lichen planus patients (Table 4) (Lakshmana *et al*., 2016). The similarities in all these studies shows the genetic susceptibility of individuals in occurring a potentially malignant disorders. *Kumar et al.* conducted a study on dermatoglyphics association with occurrence of potentially malignant disorder which showed increased frequency of whorls in oral sub mucous fibrosis and controls in contrary to the present study (Kumar *et al*., 2014). *Gupta et al* conducted a dermatoglyphic study , where there was increased frequency of arch and loop pattern along with decrease in frequency of whorl patterns with decreased ATD angle noticed (Gupta *et al*., 2013). The discrimination between the distribution of finger patterns among all these studies with present study could be attributed due to racial differences, as

anthropologically the races within India have evolved differently and above mentioned studies were conducted in different regions (Shetty *et al*., 2016). *Lakshman et al* and *Vijayraghavan et al* studies also had given the similar distribution of increased loop patterns among oral submucous fibrosis patients (Lakshmana *et al*., 2016). In present study oral leukoplakia patients showed increased finger patterns of whorls with decreased frequency of arches pattern (Graph 1). According to *Lakshman et al*. studies which showed increased loop patterns and decreased arches the discrimination between the distribution of increased whorls in present study might be due to selection of various sample size and population (Lakshmana *et al*., 2016). Control group showed increased pattern of whorls in resemblance with other studies such as *Lakshman et al, Gupta et al, Vijayraghavan et al*. No studies have been conducted to ascertain role of dermatoglyphics and lichenplanus independently. Significant increase in genetic polymorphism of the first intron of the promoter gene of interferon-gamma was found in patients with OLP (Mohammad Akhoondzadeh Haqiqi *et al*., 2016). Genetic factors influencing immune function may contribute to OLP pathogenesis. Many studies have focused on the relationship between HLA and OLP, demonstrating that an association has been observed. [(26)] Based upon the evidence provided there was an association of genetic susceptibility in lichen planes which was considered as entity in the present study that showed predominant loop patterns and decreased arches. All the case groups in present study showed decreased ATD angle compared with control mean of 41.10 ^{0} in which all cases were statistically significant (Table 1). *Gupta et al.* also concluded with decreased ATD angle in oral submucous fibrosis patients. The variations seen in studies conducted so far contradicting the role of dermatoglyphics might be reasoned out due to geographic variations (Lakshmana *et al*., 2016). *Segura‐Wang* and *Barrantes* also reported that there is a significant interpopulation variation in dermatoglyphic patterns which should be kept in mind before arriving at a definite conclusion (Segura‐Wang, 2009). The difference in the frequency of the patterns of potentially malignant disorders and oral cancer subjects reflect the underlying developmental instability, though indirectly (Cloos *et al*., 1996).

The present study constituted smaller sample size, further multicentric studies must be conducted in larger. The studies may also be carried out to evaluate the findings with those of parents of the patients suffering from potentially malignant disorders and malignancies. Although the present study reveals significant results, the scope for further research remains open as there is a paucity of similar literature for comparisons, predominantly in lichen planus. The field of dermatoglyphics holds potential results for determining the genetic susceptibility of individuals to develop potentially malignant disorders. The current study opens newer avenues in the field of dentistry as it holds definite potential to diagnose dreaded diseases at an early stage in a cost-effective manner. The relevance of dermatoglyphics is for prevention, by predicting a disease, and identification of people with the genetic predisposition to develop potentially malignant disorders.

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