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Utility of dermatoglyphics as a non-invasive diagnostic tool in recurrent aphthous stomatitis

Utilidade da dermatoglifia como ferramenta diagnóstica não invasiva para estomatite aftosa recorrente

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Abstract

Introduction: Dermatoglyphics is an advancing branch of medical science in which the dermal ridge patterns are studied and used in prediction of genetic disorders. **Objective**: To assess the usefulness of dermatoglyphics, as a non-invasive early predicator in RAS, since genetics plays a role in both. **Materials and methods**: This case control study comprised of 40 patients with recurrent aphthous stomatitis compared to 30 control subjects of similar age and sex. All subjects were investigated for their dermatoglyphic patterns of both hands, which were obtained by smearing the ink uniformly over the palm and fingers and pressing the hands firmly against the good quality paper. Qualitative analysis of prints was done for arches, loops and whorls and quantitative analysis included Total Finger Ridge Count (TFRC) and atd angle. Fisher's Exact Tests were used to evaluate the significance between recurrent aphthous stomatitis and the dermatoglyphic features. **Results**: Among various dermatoglyphic parameters analyzed, recurrent aphthous stomatitis patients showed 9% arches, 62% loops and 29% whorls as the finger ridge configuration. In comparing the

results between the two groups, the frequency of arches was observed more in study group while composite whorl and the ulnar pattern were more frequent in control group, the results were statistically significant ($p < 0.05$). In addition to this, study group patients demonstrated higher frequency of total finger ridge count, and control group showed higher frequency for atd angle on both hands, statistically significant difference is observed ($p < 0.05$). **Conclusion**: The study found significant correlation between palmar dermatoglyphics and recurrent aphthous stomatitis, suggesting that genetics is one of the host risk factor associated with the latter, and could aid in early detection of the disease.

Keywords: Arches. Dermatoglyphics. Loops. Recurrent aphthous stomatitis (RAS). Whorls.

Resumo

Introdução*: Dermatoglifia é um avançado ramo da ciência médica em que os padrões de cristas dérmicas são estudados e utilizados para predizer distúrbios genéticos.* ***Objetivo****: Avaliar a utilidade da dermatoglifia, como método de diagnóstico não invasivo para a estomatite aftosa recorrente, uma vez que a genética desempenha um papel em ambos.* ***Materiais e métodos****: Estudo caso-controle composto por 40 pacientes com estomatite aftosa recorrente comparados a 30 controles de mesma idade e sexo. Todos os sujeitos foram avaliados quanto a seus padrões dermatóglifos de ambas as mãos. Os padrões dermatóglifos foram obtidos espalhando uniformemente uma tinta sobre a palma da mão e os dedos e pressionada firmemente contra um papel de boa qualidade. A análise qualitativa das impressões foi feita por arcos, laços e espirais e a análise quantitativa pela contagem total da polpa do dedo (TFRC) e ângulo atd. Teste de Fischer foi utilizado para avaliar a significância entre estomatites recorrentes e características dermatoglíficas.* ***Resultados****: Entre os vários parâmetros dermatoglíficos analisados, os pacientes com estomatite aftosa recorrente mostraram 9% de arcos, 62% de laços e 29% de espirais na configuração da polpa digital. Ao comparar os resultados entre os dois grupos, a frequência de arcos foi mais observada no grupo de estudo, enquanto verticilos e padrão tênar foram mais frequentes no grupo controle, com resultados estatisticamente significativos ($p < 0,05$). Além disso, os pacientes do grupo de estudo demonstraram maior frequência de contagem total da polpa digital e o grupo controle apresentou maior frequência para o ângulo atd em ambas as mãos, com diferenças estatisticamente significativas ($p < 0,05$).* ***Conclusão****: O estudo encontrou correlação significativa entre a dermatoglifia palmar e estomatites recorrentes, sugerindo que a genética é um dos fatores de risco de hospedeiro associado com estomatite aftosa recorrente, e poderia ajudar na detecção precoce da doença.*

Palavras-chave*: Arcos. Dermatoglifia. Laços. Estomatite aftosa recorrente. Espirais.*

Introduction

Recurrent aphthous stomatitis (RAS) is the most common type of ulcerative oral disorder, which affects approximately 20% of the general population. Although it is not life threatening, it does diminish the overall quality of life of the sufferer, since even eating, talking and swallowing become painful. Despite of its worldwide occurrence and the extensive amount of research devoted to RAS, its etiology remains somewhat unclear. Though hereditary, nutritional, infectious and psychological factors have long been commonly associated with RAS (1, 2).

There are a number of previous studies documenting an inheritance as a strong risk factor for RAS and genetically specific HLAs have been identified in these patients (3, 4). Also an increased susceptibility to RAS has been demonstrated among the children of RAS-positive parents (3). Thus, with an ever-growing population, it becomes imperative to develop methods to identify the individuals who are at risk. The use of dermatoglyphics can be considered as a unique clinical approach at low cost for identifying such individuals.

Dermatoglyphics is an advancing branch of medical science in which the dermal ridge configurations on the digits, palms and soles are studied and used in prediction of genetic disorders (5, 6). The digit patterns are broadly classified into three major types: whorl, loops and arches, which have been subdivided into various subtypes whereas the whole of the human palm show certain other features such

as atd angle, H-loop, IV loop and t-triradius (7, 8). Dermatoglyphic patterns are genetically determined and influenced by environmental forces that are operating even before birth. They remain unchanged throughout life and unusual dermatoglyphic patterns often relate to genetic disorders (5).

Dermatoglyphics is currently used as a non-invasive early predicator of many illnesses (5). This science has been widely used to identify systemic disorders and to analyze the role of genetics in their etiology and is becoming acceptable now as a diagnostic tool among medical personnel (5, 6, 9). It is considered a window into congenital abnormalities and is a sensitive indicator of intrauterine dental anomalies too (10).

In the field of dentistry, several studies have shown the association of dermatoglyphics with different types of oral diseases, like cancer, precancer, bruxism, cleft palate, caries and periodontal diseases (7, 8, 11-15). However, there is no publication to date that addresses the dermatoglyphic patterns in recurrent aphthous stomatitis. Therefore this study was undertaken with the following aims: (i) to study a correlation of dermatoglyphic patterns with RAS; (ii) to determine the usefulness of dermaoglyphics in order to identify and isolate the higher risk associated with certain patients.

Materials and methods

This Institutional Ethical Committee approved (approbation number - DMIMS (DU) / IEC/ 2010-11/ 44) case control study included 70 subjects, selected from those attending the outpatient department of Oral Medicine and Radiology, Sharad Pawar Dental College, Wardha. Out of these, 40 patients were suffering from recurrent aphthous stomatitis and 30 were age and sex matched controls. Control subjects were recruited randomly among the volunteer patients who had reported to the department for their dental check-up.

In inclusion criteria, there were patients with clinical presentation of aphthous ulcers, and had apositive history of recurrent painful similar ulcerations, three to six episodes per year. In exclusion criteria were patients having any oral diseases (like oral submucous fibrosis and candidiasis), systemic diseases (such as Behçet Syndrome, Celiac or Crohn's disease, nutritional deficiency, cardiovascular, respiratory, metabolic and endocrinal disorders) and patients taking medication for systemic diseases or having history such as history of radiotherapy, which could cause oral ulcerations.

Patients were informed about the research study, its procedure and their written consent was obtained. Diagnosis of RAS was based on detailed history and its characteristic clinical presentation. A painful round or oval, shallow ulcer, regular in outline, with a grey-white pseudomembrane and surrounded by a thin erythematous halo was diagnosed as aphthous ulcer. Based on the size and clinical characteristics, these were classified into minor, major and herpetiform (2, 16). In doubtful cases, blood investigations were performed to rule out the ulcers associated with other diseases. Biopsy was not performed for any of the patients.

Minor ulcers, which comprise over 80% of RAS cases, are less than 1 cm in diameter and heal without scars. Major ulcers are over 1 cm in diameter and take longer to heal and are accompanied by scar. Herpetiform ulcers are considered a distinct clinical entity that manifests as recurrent crops of dozens of small ulcers throughout the oral mucosa (3, 16). Then the dermatoglyphic data, which included bilateral finger and palm prints, were collected from the same subjects and 30 control subjects, using the stamp pad ink method. These were then analyzed qualitatively and quantitatively.

Procedure for obtaining prints

Hands of all patients were washed with soap and water to remove sweat, oil and dirt from the skin in order to enhance the quality of dermatoglyphic prints. Then a small amount of ink was smeared thoroughly and uniformly over the palm and fingers with a piece of gauze. Prints of the distal phalanges of the ten fingers and the palms were taken by pressing firmly against the good quality paper kept over the table. The finger prints were taken from thumb to little finger. Qualitative analysis of fingers and palm prints was done. Fingertip patterns were studied for arches (A), loops (L) and whorls (W) as shown in Figure 1, whereas palmar patterns were analyzed for the presence of arches, loops and whorls in hypothenar area, thenar/first interdigital area (I1), I_2, I_3 and I_4 interdigital area (Qualitative analysis) as shown in Figure 2 (11, 12). Quantitative analysis included total finger ridge count (TFRC) and atd angle.

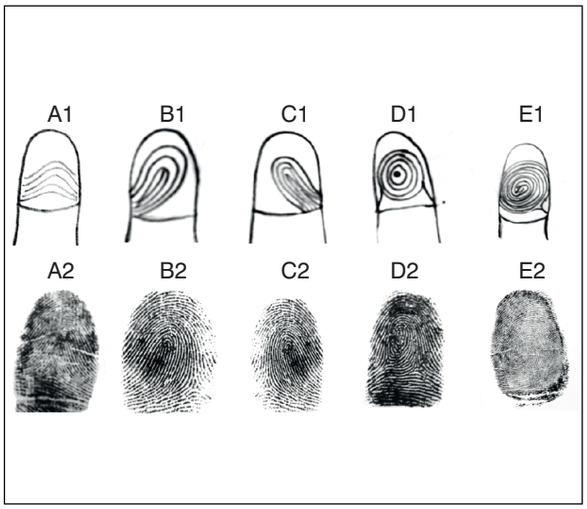


Figure 1- Finger print patterns for dermatoglyphics
Legend: A1 and A2 = arch; B1 and B2 = ulner loop; C1 and C2 = radial loop; D1 and D2 = Simple whorl; E1 and E2 = composite whorl.
Source: Research data.

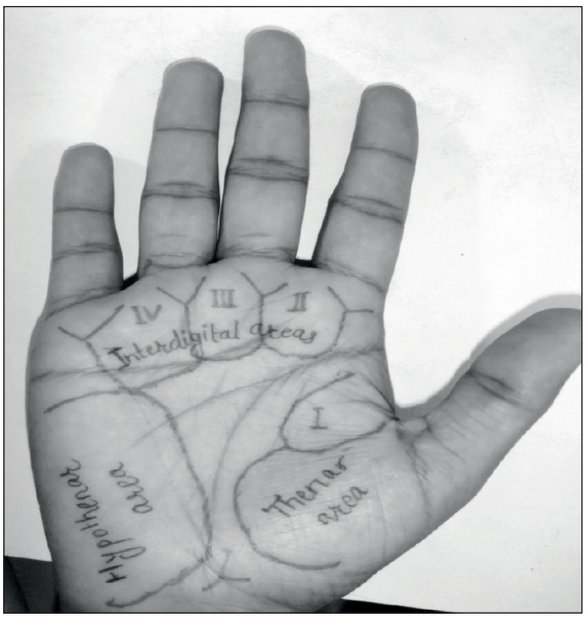


Figure 2 - Palmar landmarks for dermatoglyphics
Source: Research data.

The statistical analysis was performed using SPSS package and MINITAB (Version IV, USA) by recording the findings in tabular format. Fisher's Exact Test and Student's t-test were used to evaluate the significance of the parameters between different groups. For the parameters, 95% confidence intervals were calculated.

Results

The dermatoglyphic patterns were evaluated in 40 RAS patients (mean age 23.60 ± 7.99) and 30 age and sex matched controls (mean age 25.23 ± 9.32). Amongst all participants, 57% were female and 43%, male. Out of all RAS patients, 60% (24 out of 40) confirmed a positive history of RAS amongst their family members and 77% (31 out of 40) RAS patients were suffering from minor type of aphthous ulcers. The most prevalent site of RAS was tongue, followed by labial mucosa (14 patients – 35%, 11 patients – 27%, respectively). Table 1 presents information related to RAS in the study subjects.

Table 1 - Information related to recurrent aphthous stomatitis in study subjects (Out of 40)

Variants		n (%)
History of RAS in family members	Positive	24 (60)
	Negative	16 (40)
Duration of RAS	< 1 year	15 (37)
	1-5 years	21 (52)
	> 5 years	4 (10)
Type of RAS	Minor	31 (77)
	Major	2 (5)
	Herpetiform	7 (17)
Site of ulcers	Tongue	14 (35)
	Labial mucosa	11 (27)
	Buccal mucosa	8 (20)
	Floor of mouth	4 (10)
	Gingiva	3 (8)
Association with pain	Yes	37 (92)
	No	3 (8)

Source: Research data.

Analysis of finger print pattern between the study and control groups

The distribution and comparison of various fingerprint patterns in all subjects is shown in Table 2. In RAS patients, 9% were arches, 62% were loops and 29%, whorls, as the ridge configuration. Amongst all dermatoglyphic patterns, the frequency of ulnar loops was highest in RAS subjects (Table 2).

Table 2 - Comparative analysis of Finger print pattern between study and control groups (Out of 70)

Pattern		Study Group (n = 40)	Control Group (n = 30)	Fisher's Exact Test p-value
Arches		36 (9%)	5 (1.67%)	0.02
Loops	Ulnar	234 (58.5%)	184 (61.33%)	0.77
	Radial	14 (3.5%)	6 (2%)	0.40
Whorls	Simple	103 (25.75%)	76 (25.33%)	0.87
	Composite	13 (3.25%)	29 (9.66%)	0.04

Source: Research data.

On comparison of the fingerprint patterns of RAS patients with those of the control subjects, it was observed that RAS patients had an increased frequency of arches whereas control subjects had a higher frequency of composite whorl patterns. The results were found to be statistically significant ($p < 0.05$).

Analysis of palm print pattern between the study and control groups

On comparison of dermatoglyphic patterns of arches, loops and whorls at the hypothenar and interdigital areas I_1, I_2, I_3, I_4 of right and left hands amongst RAS and control subjects, no significant differences were noted. While the comparison of similar patterns in thenar areas (I1) of both hands showed statistically significant results between the two groups. Higher frequency for thenar areas was observed in control group, as shown in Table 3 ($p = 0.03$, Fisher's Exact Test). The present study showed increasing arch patterns in the hypothenar area.

On comparative evaluation between the two groups, the present study demonstrated lower mean values of atd angle on both hands of RAS patients but the result was found to be statistically significant for the right hand only, as shown in Graph 1 (p-value for right hand was 0.02, significant and p-value for left hand was 0.09, non-significant).

In addition, the study showed significant difference in the mean TFRC between the two groups ($p < 0.05$). The higher mean TFRC value is observed in study group, as shown in Table 4.

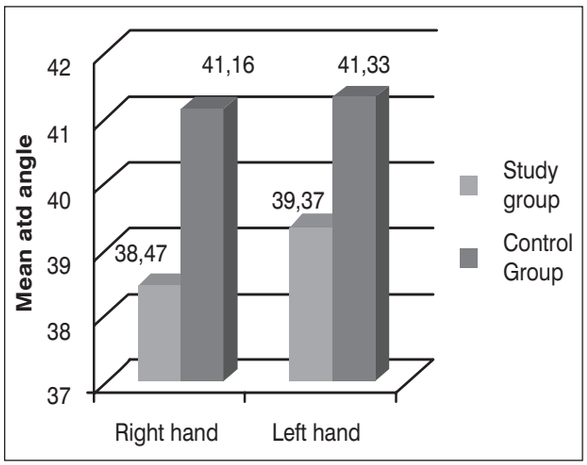
Discussion

The genetic message contained in the genome — normal or abnormal — is deciphered during the intrauterine period and is also reflected by dermatoglyphics, thus it serves as a means of identification of certain abnormalities of genetic etiology (12).The findings of the present study revealed statistically significant differences in the dermatoglyphic patterns of

Table 3 - Comparative analysis of Palm print patterns between study and control groups (Out of 70)

Pattern	Side	Study Group (n 40)	Control Group (n 30)	Fisher's Exact Test p-value
Hypothenar	R	6 (15%)	22 (73%)	0.32
	L	8 (20%)	20(67%)	
Thenar/ I1	R	0 (00%)	4 (13%)	0.03
	L	2 (5%)	4 (13%)	
I2	R	6 (15%)	11 (37%)	0.40
	L	5 (12%)	13 (43%)	
I3	R	20 (50%)	19 (63%)	0.20
	L	14 (35%)	19 (63%)	
I4	R	24 (60%)	15 (50%)	0.49
	L	29(72%)	15 (50%)	

Source: Research data.



Graph 1 - Comparative mean values of atd angle in RAS and control subjects

Source: Research data.

Note: Student's t-test, p-value for right hand - 0.02, p-value for left hand - 0.09.

Table 4 - Comparative analysis of mean values of Total finger ridge count between study and control groups (Out of 70)

Groups	Mean	s.d.	t-value	p-value
Study group(n=40)	152.82	35.87	3.32	0.001
Control group(n=30)	127.31	23.72		

Source: Research data.

fingers and palm between the controls and RAS population, allowing us to conclude a genetic difference between the two groups. This may be used to identify the RAS prone patients and enhance their awareness about the condition.

The etiological role of genetics in RAS is well known (1, 4). Undoubtedly family history has the strongest correlation with RAS. Also, in this study, 60% of patients gave a positive history of RAS amongst their family members, which is comparable to the study by Koybasi et al. (17). It has been stated in literature that patients with RAS-positive parents had a 90% chance of developing RAS, whereas patients with no RAS-positive parents had a 20% chance of developing the lesions (3). According to Ahmed et al. (7), in response to environmental exposures, genetic damage accumulates more quickly in individuals with genetic susceptibility to DNA damage. Consequently, those individuals might be at a greater risk of developing lesions.

Regarding the type of RAS, the results of the present study are consistent with previous literature, which described that approximately 80% and 67.74% of patients with recurrent aphthous ulcerations were exhibiting minor type of RAS (4, 16).

Various dermatoglyphic patterns such as higher frequency of ulnar loops (58.5%), arches (9%), simple whorls (25.75%) and lower frequency of composite whorls (3.25%) in RAS patients are observed to be comparable with the dermatoglyphic patterns of children having cleft palate as well as patients suffering from oral cancer and precancer (11, 12). On the other hand, patients with history of bruxism demonstrated decrease in frequency of loops (13). Actually, decrease in frequency of loops was a constant feature in dental caries patients in a number of previous studies while there was an increase in frequency of whorls amongst them (7, 8, 18).

The present study showed higher frequency of arches in RAS patients, comparable to the dermatoglyphic pattern of patients with oral leukoplakia and oral squamous cell carcinoma (11). However, individuals with cleft palate did not show significant difference in arch pattern between study and control group (12).

The frequency of composite whorls was higher in control group as compared to RAS patients in the present study (significant, pe was 0.04) while composite whorls were found common in dental caries patients who wore fillings, as mentioned in the study by Ahmed et al. (7).

On comparative analysis of palm prints of both hands between the two groups, statistically significant difference was noted between the dermatoglyphic patterns of I1 interdigital areas only. The present study also revealed that the control group was characterized by increasing arch patterns in the hypothenar area, which is in agreement with Atasu (18).

The higher mean TFRC value in study patients was an additional significant finding of the present study, which is analogous to dental caries patients wearing fillings (7). On the contrary, bruxism patients and the ones suffering from oral cancer and precancer showed no significant TFRC values (11, 13).

In this study it was observed that RAS patients had lower mean values of atd angle on right and left hands when compared to control subjects, whereas the study by Mathew et al. (12) showed controversial results with reference to atd angles between two groups, which was stated to be higher in the oral cleft children.

In harmony with the results of previous studies about dermatoglyphics in several oral disorders, this study detected a definite correlation between the dermatoglyphic patterns and RAS, results which encourage future studies to assess the impact of genetic factors on RAS onset and symptoms.

In humans, a dynamic series of events concerned with facial development takes place during the second month of intrauterine life. During this period, building blocks of the face forms and organizes into a recognizable human face and primitive oral cavity as well (19). The dermal ridges develop in relation to the volar pads, during the same period of gestation and reach maximum size between 12th and 13th weeks (12). Based on the results of the present study, it can be hypothesized that many genes which are influencing finger and palmar dermatoglyphic development can also give an indication to the development of RAS. Hence, identifying people at high risk for RAS could be of great value to dermatoglyphics. Palmer dermatoglyphics can be used to screen RAS prone and RAS positive patients.

The advantage of dermatoglyphics is that the epidermal ridges of palms and fingers are fully developed at birth and thereafter remain unchanged. Thus, scanning or recording of these can be accomplished rapidly, inexpensively and without causing any trauma to the patient at any age. The limitation of this study is that dermatoglyphic pattern does not correlate to the severity of RAS.

Conclusion

Due to absence of definitive etiopathogenesis and diagnostic tests, the identification of aphthous ulcers relies on the combination of history and clinical features. However, sometimes it mimics many others oral disorders. In such cases, dermatoglyphics can serve to strengthen a diagnostic impression in RAS as a definite correlation is observed between the dermatoglyphic patterns and RAS. Most importantly, it may help to identify and isolate the higher risk associated with certain patients (based on dermatoglyphics).

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