DOI: 10.7860/JCDR/2023/59561.17689

Original Article

Dentistry Section

Role of Dermal Ridge Patterns in Prediction of Periodontal Disease- A Cross-sectional Study

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ABSTRACT

Introduction: Periodontitis is a chronic inflammatory disease which affects the supporting tissues of the teeth and was initially thought to be environmental in origin. The difference in the disease prevalence among the population could not be attributed to environment alone. Limited studies have been done on diagnosing the future occurrence of periodontal diseases by recording the fingerprint patterns of the patients.

Aim: To evaluate the relationship between fingerprints patterns existing among patients with plaque induced gingivitis, chronic localised and generalised periodontitis.

Materials and Methods: This was a cross-sectional observational study, carried out over a period of 6 months from January 2022 to July 2022 at Rajas Dental College and Hospital, Kavalkinaru, Tamil Nadu, India. Subjects were equally divided into three groups including 100 patients under each group: Group I as plaque induced gingivitis, group II as localised chronic periodontitis and group III as generalised chronic periodontitis based on 1999 classification system. The fingerprint patterns observed were loops, whorls and arches. The fingerprint patterns were compared within the group and also between the three groups. Boneferroni test and Analysis of Variance (ANOVA) test were used for statistical analysis.

Results: Total of 300 patients were included in this study, out of which 175 were males and 125 were females with the mean age 34.16±1.33 years. On comparison of the fingertip patterns within the groups, a significantly equal distribution of whorl and loop patterns with a value of 4.950±3.10 and 4.750±3.09 respectively were found among the group I subjects. A significantly increased prevalence of whorls with a value of 5.300±3.37 was found in group II subjects and significantly increased prevalence of loop pattern with a value of 5.800±2.72 was found among group III subjects. The arch pattern was more in group II and group III when compared to group I with a value of 1.450±2.21 and 1.200±1.33, respectively.

Conclusion: It was concluded that a strong association between fingerprint patterns and chronic periodontitis existed. The present study proved that dermatoglyphics can be used as a powerful tool for early prediction and better prevention of periodontitis.

Keywords: Arches, Dermatoglyphics, Loops, Periodontitis, Ulnar

INTRODUCTION

Gingivitis is an inflammatory lesion which results from the interaction between dental plaque biofilm and immune responses of the host. In gingivitis, inflammation does not extend to involve the periodontal attachment [1]. Chronic periodontitis is a disease of infectious origin which results from the inflammation within the supporting tooth structures and results in progressive loss of attachment and bone loss. It is the most frequently occurring pattern of periodontitis in adult population [2]. Initially, periodontitis was thought to be a disease of microbial and environmental origin. However, it could not be attributed to the microbial or environmental factors alone due to differences in disease variations [3]. This could be mainly because of the genetic makeup which causes the differences in the susceptibility of an individual [4]. Dermatoglyphics deals with the patterns of skin ridges present on the soles, fingers and toes of human [5]. Dermatoglyphics is a Greek word meaning Derma=skin; Glyphe=carve [6]. The fingerprints which are completely developed after the birth of the child, remains unchanged during the entire lifetime [7].

In dentistry, the methods available to rule out the genetic basis of periodontal diseases are expensive and limited. Since dermatoglyphics have a genetic basis, they can also be used for diagnosing oral diseases with genetic inheritance [8]. Various studies have ruled out periodontal disease with genetic aetiology. Kornman KS et al., have studied the genetic polymorphism of tumour necrosis factor-α, interleukin-1 (α and β), CD14 promoter region and proved them as a risk factor for chronic periodontitis [9]. A study done by Atasu M et al., indicated the correlation between dermatoglyphics and aggressive periodontitis [10]. Dermatoglyphics have been considered as a valuable tool in identifying patients with periodontal diseases [11].

A successful treatment relies on the early detection of disease. Traditional periodontal parameters have its own limitations [11]. The recent diagnostic methods to determine the genetic basis of periodontitis are expensive and technique sensitive. Dermatoglyphics can alleviate this predicament [12]. Studies have been done evaluating the fingerprint patterns among the healthy subjects and compared with either chronic periodontitis or aggressive periodontitis patients [10,13,14]. Till now no studies have shown reports comparing the fingerprint pattern distribution among the localised and generalised chronic periodontitis patients.

The current study was aimed at detecting the fingerprint pattern variations among the localised and generalised chronic periodontitis patients and the objective of this research was to predict the future development of periodontal disease using fingerprint patterns among patients with plaque induced gingivitis, chronic localised and generalised periodontitis.

MATERIALS AND METHODS

This cross-sectional observational study was carried out over a period of 6 months from January 2022 to July 2022. A total of 300 subjects within the age group of 20-50 years who reported as an Outpatient to the Department of Periodontology and Implantology, Rajas Dental College and Hospital, Kavalkinaru, Tirunelveli, Tamil Nadu, India. Prior to the study, Ethical Clearance (approval number RDCH/IRB/03/2022) from the Institutional Ethics Committee and an informed consent from the patient were obtained.

Inclusion criteria: Systemically healthy male and female patients within the age group of 20-50 years were included.

Exclusion criteria: Patients with absence of digit, conditions/abnormalities that did not allow accurate recording of fingerprints, smokers, pregnant females, patients on antibiotics or other medications and patients who had undergone oral prophylaxis in past 6 months were excluded.

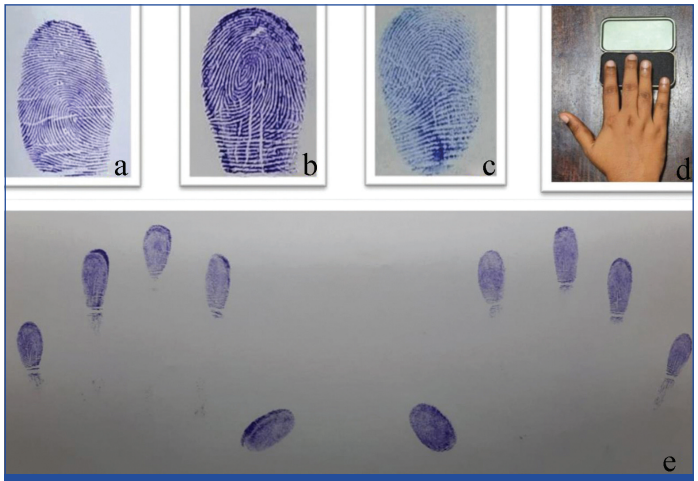
Sample size calculation: The sample size was determined using nMaster 2.0 sample size software based on hypothesis testing means obtained from previous study [13]. The minimum sample size obtained was 100 per group with equal allocation.

Procedure

The diagnosis of periodontitis was made based on the American Academy of Periodontology, 1999 classification system depending on the level of clinical attachment, degree of inflammation, probing depth and bone loss [15]. Russel's Periodontal Index was evaluated for all the patients before grouping them to facilitate the surveillance of periodontal disease [16]. Patients were divided into three groups as follows-

- Group I (n=100): Plaque induced gingivitis,
- Group II (n=100): Localised chronic periodontitis and
- Group III (n=100): Generalised chronic periodontitis.

All participants in the study were given liquid soap for washing their hands before recording the fingerprints. For each individual, 10 fingerprints were recorded. Participant's fingerprint were recorded using standard ink method [17], by the use of blue duplicating ink, thick white printing paper and a sponge pad. For each individual, the fingerprints were recorded from both the right and left hand. Every individual's fingerprint were evaluated under adequate light with the help of magnifying glass. On distal phalanges of the finger, three patterns of fingerprints were evaluated namely-loops, whorls and arches [Table/Fig-1a-e].



[Table/Fig-1]: (a) Loops; (b) Whorls; (c) Arches; (d) Standard ink method; and (e) Fingerprints.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Statistics USA) software. Overall intragroup comparison and individual intergroup comparison was done using Analysis of Variance (ANOVA) test and p-value was set by posthoc analysis using Bonferroni test adjusted for comparing multiple variables. For statistically significance p-value was set as <0.05.

RESULTS

Among the 300 patients included in this study, 175 were male patients and 125 were female patients. The mean age of the patients involved in the study was 34.16±1.33 years. On comparing the fingertip patterns within the groups [Table/Fig-2], a significantly equal distribution of whorl and loop patterns with a value of 4.950±3.10 and 4.750±3.09 respectively were found among the group I subjects. A significantly increased prevalence of whorls with a value of 5.300±3.36 was found in group II subjects and significantly increased prevalence of loop pattern with a value of 5.800±2.72 was found among group III subjects. The arch pattern was more in group II and group III when compared to group I with a value of 1.450±2.21 and 1.200±1.33, respectively. On comparing the fingerprint patterns between the groups [Table/Fig-3], there was significant difference (p-value <0.05) for whorl pattern and loop pattern were more when group II was compared to group III. However, no significant difference for arches was seen when group II was compared with group III (p-value=0.830).

Patterns	Groups	N	Mean	Standard deviation	p-value
Whorls	Group I	100	4.950	3.105	<0.001
	Group II	100	5.300	3.365	
	Group III	100	3.050	2.868	
Loops	Group I	100	4.750	3.095	<0.001
	Group II	100	3.250	2.893	
	Group III	100	5.800	2.726	
Arches	Group I	100	0.300	1.105	<0.001
	Group II	100	1.450	2.212	
	Group III	100	1.200	1.333	

[Table/Fig-2]: Intragroup comparison of whorls, loops and arches in group I, group II and group III.
p-value based on Analysis of Variance (ANOVA)
p-value <0.05 was considered to be significant

Patterns	Groups		Mean difference	p-value
Whorls	Group I	Group II	0.350	1
		Group III	1.900	<0.001
	Group II	Group III	2.250	<0.001
Loops	Group I	Group II	1.500	0.001
		Group III	1.050	0.034
	Group II	Group III	2.550	<0.001
Arches	Group I	Group II	1.150	<0.001
		Group III	0.900	<0.001
	Group II	Group III	0.250	0.830

[Table/Fig-3]: Individual intergroup comparison between group I, group II and group III.
p-value based on Post-hoc analysis using Bonferroni Test after adjusted for multiple comparisons
A p-value <0.05 was considered to be significant

DISCUSSION

Periodontitis is a disease of multifactorial origin associated with various factors such as environmental factors, systemic and genetic factors. The fingerprint patterns have characteristics which make them important for various identification and diagnostic procedures [13]. The present study was conducted with the aim to determine the specific fingerprint pattern type associated with plaque induced gingivitis, chronic localised and generalised periodontitis. Once formed, the fingerprint patterns remain unchanged and age and environmental remains stable [14,18]. In the present study, 300 fingerprints were analysed from 100 patients allocated in each group.

In this study, a statistically higher frequency of transversal ulnar loops and concentric whorls on all fingers of adult periodontitis patients were seen. Whorls pattern were significantly more in group II patients and loop patterns were more among the group III patients. This finding was in accordance with the study conducted by Chatterjee G et al., and Deotale S et al., who found increased prevalence of loop patterns among chronic generalised periodontitis patients [19,20]. A study conducted by Vaidya P et al., also mentioned the increased prevalence of whorls and decreased arch pattern among right and left fingers of the chronic periodontitis patients [13]. In contrast to the findings of the current study, Astekar S et al., and Rathod S et

al., reported increased prevalence of loop patterns among healthy subjects compared to the periodontitis subjects [21,22]. In present study, whorls and loops were nearly equally distributed among the group I patients with a value of 4.950±3.105 and 4.750±3.095, respectively. Group II showed less number of loops compared to group III patients which was similar to a study by Atasu M et al., who reported more number of loops in patients with periodontitis when compared to healthy controls [10]. In another study, Kochhar GK et al., found more number of loops in patients with high oral hygienic index and lower number of loops in periodontitis patients when compared to healthy controls [23].

Shyamala K et al., conducted a study comparing the fingerprint pattens among healthy subjects and aggressive periodontitis patients and found that single loop pattern was more prevalent in aggressive periodontitis subjects [24]. A study done by Kranti K et al., showed no statistically significant differences in fingerprint types among generalised chronic periodontitis and healthy subjects [25]. Although many studies have been conducted in an attempt to find an association between the dermatoglyphics and periodontal disease, the results of the studies are inconclusive and the association between the periodontitis and dermatoglyphics is yet to be proved. The present study uniquely focused on finding the differences in fingerprint patterns among localised and generalised chronic periodontitis subjects. Findings of various studies that have been done to prove the association between periodontal disease and fingerprint patterns have been tabulated in [Table/Fig-4] [10,13,19-22,24,25].

S. No.	Authors name and year	Place of study	Number of subjects	Age (mean age)	Parameters compared	Conclusions
1.	Atasu M et al., (2005) [10]	Istanbul, Turkey	Healthy subjects- 17 male 22 female Adult periodontitis- 19 male 19 female Rapidly progressive- 24 male 21 female Juventile periodontitis- 13 male 23 female	34.16 46.76 14-48 15-33	Percentage frequencies of pattern types on all fingers of patients were compared with healthy subjects and school children	No statistically significant differences in fingerprint patterns between the healthy, diseased and the school children group. A slight increase in the prevalence of loops were seen in periodontally diseased patients when compared to healthy subjects.
2.	Vaidya P et al., (2017) [13]	Maharastra	Chronic periodontitis-100 Periodontally healthy-100	-	Fingerprint patterns were compared	Statistically more whorls and less arches in both right and left hands in patients with chronic periodontitis.
3.	Chatterjee G et al., (2017) [19]	Udaipur	Generalised chronic periodontitis-437 Chronic generalised gingivitis-363	-	Fingerprint patterns were compared	Increased frequency of radial loop pattern (39.01%) was found in chronic generalised gingivitis subjects and higher frequency of ulnar loop (37.53%) and central pocket whorl pattern (36.16%) was observed in generalised chronic periodontitis subjects
4.	Deotale S et al., (2016) [20]	Nagpur	Generalised Chronic Periodontitis-60 Healthy subjects -60	30±12	Fingerprint patterns and palmar accessory tri-radii were compared	Statistically significant higher percentage of ulnar loops (80.5%) was seen in CGP patients as compared to a majority of whorls (80.17%) in the healthy controls (p-value <0.001).
5.	Astekar S et al., (2017) [21]	Uttar Pradesh	Clinically diagnosed periodontitis -30 Periodontally healthy -30	15-30	Finger ridge patterns were compared	Whorl pattern was found to be the most common in the study group whereas loop pattern was the most common in the control group.
6.	Rathod S et al., (2019) [22]	Maharastra	Periodontally healthy-15 Aggressive periodontitis-15 Chronic periodontitis-15	18-45	Fingerprint patterns were compared	An increased frequency of whorls was found in patients with aggressive periodontitis and chronic periodontitis, whereas increase frequency of ulnar loop was found higher in the healthy group.
7.	Shyamala K et al., (2015) [24]	Bangalore	Aggressive Periodontitis-30 Healthy subjects- 30	20-35	Right and left fingerprint patterns of the test and control goup was compared	Increased frequency (60%) of DLW on left and right thumb of study group and presence of SLW (60%) on left ring fingers of study group was observed.
8.	Kranti K et al., (2018) [25]	Bengaluru	Generalised Chronic Periodontitis-60 Healthy subjects-30	17-65	Fingerprint patterns were compared	Ulnar loops were found to be the most common fingerprint type in both periodontally healthy and diseased groups, however it had no statistically significant coherence with either.
9.	Present study (2023)	Tamil Nadu	Plaque induced gingivitis-100 patients, Localised chronic periodontitis-100 patients and Generalised chronic periodontitis-100 patients	20-50	Fingerprint patterns	Significantly higher frequency of whorls was present in localised chronic periodontitis patients and a higher frequency of loop pattern was seen in generalised chronic periodontitis patients.

[Table/Fig-4]: Various studies associated with dermatoglyphics and periodontal disease.
CGP: Comprehensive genomic profiling

Limitation(s)

The limitations of this study included the absence of involvement of aggressive periodontitis subjects. Subtypes of fingerprint patterns were not included in this study. Accessory tri-radii pattern role was also not recorded in this study.

CONCLUSION(S)

The assessment revealed a statistically higher frequency of whorls in localised chronic periodontitis patients and a higher frequency of loop pattern in generalised chronic periodontitis patients. Thus, the present study proved that dermatoglyphics can be used as a powerful tool for early prediction and better prevention of periodontitis. This study can be used to create awareness among the patients regarding the chances of future occurrence of periodontal tissue destruction.

Within the limitations of the study, it was concluded that a strong association between fingerprint patterns and chronic periodontitis exists. However, various studies of larger sample size to prove the association between dermatoglyphic patterns and periodontitis is required.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Aug 15, 2022
- Manual Googling: Oct 18, 2022
- iThenticate Software: Oct 28, 2022 (23%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Aug 09, 2022**
Date of Peer Review: **Sep 14, 2022**
Date of Acceptance: **Nov 01, 2022**
Date of Publishing: **Mar 01, 2023**