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Determination of the Correlation between Dermatoglyphics and Periodontitis: A Case Control Study

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Abstract

Background: Periodontitis is an inflammatory disease of the supporting tissues of the teeth resulting in progressive destruction of the periodontal ligament and alveolar bone. The understanding of the aetiology and pathogenesis of the disease currently being hosted response of disease susceptible individuals to the bacterial products. Fingerprint patterns, being unique, unaffected by the environment, have a unique role in identifying an individual and their phenotype characteristics. Determine the correlation between dermatoglyphics and periodontitis and to compare the patterns of individuals with healthy periodontium and those with periodontitis. **Materials and Methods:** Dermatoglyphic patterns of 143 patients with healthy periodontium and 143 patients with periodontitis were analysed to determine the variations of dermatoglyphic patterns: Ulnar loop (U), Radial loop (R), Whorls (W) and Arches (A). The study groups used in this study are: Control, Chronic Periodontitis (CP) and Aggressive Periodontitis (AP). Chi-square test of association (two-tailed) is used for the analysis, and the significance level is taken to be $p<0.05$ Statistical Analysis was carried out using statistical package, SPSS (version 22.0.0.0). **Results:** The observations made in the study were a decrease in double loops in aggressive periodontitis and chronic periodontitis, a decrease in ulnar loops and concentric whorls in aggressive periodontitis and an increase in transverse ulnar loops, symmetric whorls, concentric whorls and plain arches in chronic periodontitis. **Conclusion:** Dermatoglyphics can hence be used for early detection and implementing preventive measures for periodontitis susceptible individuals.

Keywords: Aggressive Periodontitis, Chronic Periodontitis, Dermatoglyphics, Finger Print Patterns

1. Introduction

Since time immemorial, physicians, anthropologists, have found the study of the human hand to be a subject of interest. In 1926, Cummins coined the term Dermatoglyphics, the study of configuration of epidermal ridges on surface of the hands, and feet which appear during the third and fourth month of intrauterine development[1,2].

These patterns being unique, remain the same throughout a lifetime and thus helps in unmasking the genetic related medical and other characteristics[1]. Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with increased probing depth formation, recession or both[1].

The understanding of the aetiology and pathogenesis of the disease has undergone a paradigm shift from colonisation of bacterial species in the periodontal pocket

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to the host response of disease susceptible individuals to the bacterial products.

Finger print patterns are the unique elevated ridges on human fingertips, soles of feet and palms of hands[1].

The patterns develop between 13th to 19th weeks of intra uterine life[3]. Once a definite pattern is set, they remain unaltered, hence can help in identifying an individual and their phenotype characteristics[4] Changes or disturbances during pregnancy, can lead to variations in the dermatoglyphic patterns of the foetus; thereby indicating genetic or chromosomal abnormalities[5].

Fingerprints have three basic patterns (Figure 1)

a. **Arches:** Found in 5% of finger prints. The pattern starts from any side and end on the other side, without any backward turns. Arches are further classified as plain, Ulnar, Radial and tented arches.
b. **Loops:** Constitute 60-70 % of patterns. The ridge(s) starting from a side of the impression, recurves, meets the line connecting the delta and core, finally ending on the same side. In an Ulnar loop, ridges are found opening towards the ulnar side, while in radial loop, they open towards the radial side.
c. **Whorls:** found in 25-35 % of finger prints. Few ridges turn in at least once in a circuit. A pattern with more than two deltas forms a whorl.
   i. Concentric whorl – seen as concentric rings around the core.
   ii. Spiral whorl - spiral patterns with the core in centre, either in the clockwise or in anticlockwise direction.
   iii. Mixed whorl- spirals and circles in a single pattern.
   iv. Central pocket whorl- a loop enclosing a smaller pocket.
   v. Twin whorl- pattern starts at a core and open on the opposite end of the finger.
   vi. Accidental whorls- two or more of abovementioned patterns[6].

Advanced study designs and genomic technologies are being employed to add on to the current evidence that the role played by the genetic inheritance is almost at par with that of the environmental factors. Success of these endeavours would mean accessibility to the information coded in the genes, and incorporating into the evidence based diagnosis, prevention and treatment[1] Also this would contribute to the interdisciplinary approach including key members of dentistry, genomics and bioinformatics working hand in hand to develop significant results[2].

Hence the study aims to determine the correlation between dermatoglyphics and periodontitis and to compare the patterns of individuals with healthy periodontium and those with periodontitis.

2. Materials and Methods

The study is a case control study, conducted after obtaining the approval of the Ethical board (Reference no: 014/08), Annoor Dental College and Hospital, Muvattupuzha, Kerala, India. The subjects for the study were selected on a random basis from amongst the out patients visiting the Department of Periodontology, Annoor Dental College and Hospital

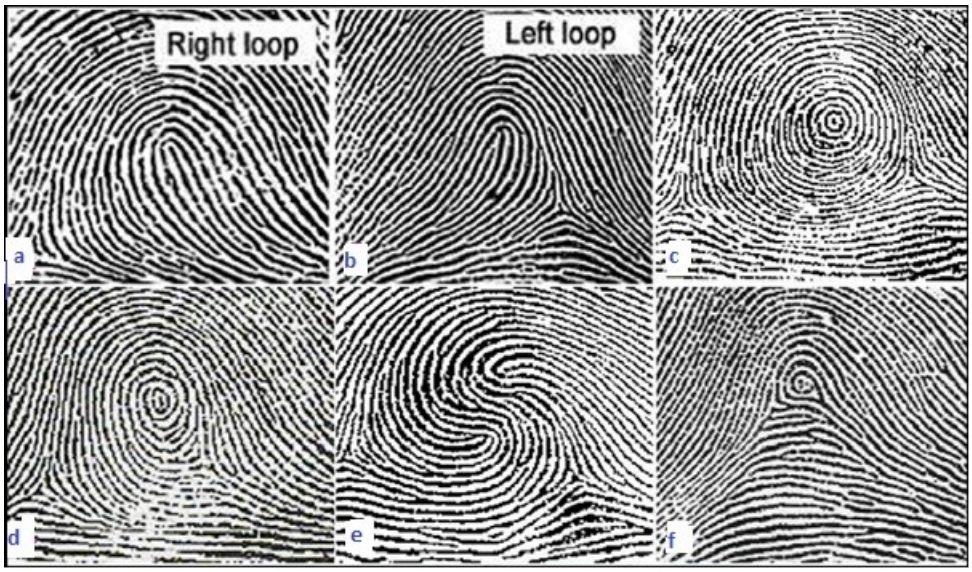


Figure 1. Fingerprint patterns a) Right loop b)Left loop c) Plain whorl d) Central pocket whorl e) Double loop f) Accidental whorl.

between July 2015 to July 2016. Informed consent was obtained from the subjects after explaining the objectives of the study. The sample size calculated with effect size 0.3329 and level of significance of 0.05, using the formula

$$n = \frac{\left(Z_{\alpha/2} + Z_{\beta}\right)^2 \sigma^2}{d^2}$$

where $Z_{\alpha/2}$ is the value of Z at 0.05 significance level, Z_{β} is the value of Z at 80% power, σ is the population standard deviation and d is the clinical difference (or the difference in means) as 286 dermatoglyphic patterns, divided into two groups:

Test group: 143 patients with periodontitis.

Control group: 143 systemically healthy patients with no evidence of periodontitis. Systemically healthy individuals with periodontitis, with probing depth more than 5mm and clinical attachment loss of more than 3mm in more than 30% of sites were included in the study. Patients with systemic diseases/conditions influencing periodontal diseases and those with a history of any periodontal surgery done were excluded from the study.

The thumb finger, index finger, middle finger, ring finger and the little fingers of right and left hands were denoted as finger I, II, III, IV and V respectively.

Prior to obtaining the fingerprints, hands were scrubbed thoroughly with an antiseptic lotion and allowed to dry. After this, the subjects' hands were guided by the researcher and pressed firmly against the 6×10 inch disposable fingerprint ink strips that were placed on a smooth surface board, in a roll method. The patterns were obtained on pre formed formats and analysed with the help of fingerprint analysis expert (Figure 2a, b, c, d).

3. Statistical Analysis

The present study deals with testing whether there is any association among presence of patterns Ulnar loop (U), Radial loop (R), Whorls (W) and Arches (A) with the study groups. The study groups used in this study are – Control, Chronic Periodontitis (CP) and Aggressive periodontitis (AP). Chi-square test of association (two-tailed) is used for the analysis, and the significance level is taken to be $p<0.05$ Statistical Analysis of the study was done using statistical package, SPSS (version 22.0.0.0).

4. Results

4.1 Association of Patterns for Finger V

It was observed that for left finger, there is no association of presence of pattern A with the study groups (p=0.410). For right finger, there is no association of presence of pattern R with the study groups (p=0.134). For the remaining patterns there is association of presence of patterns with the study groups (p=0.00). For pattern R, the analysis is not done as that pattern is not present in left finger (Figure 3).

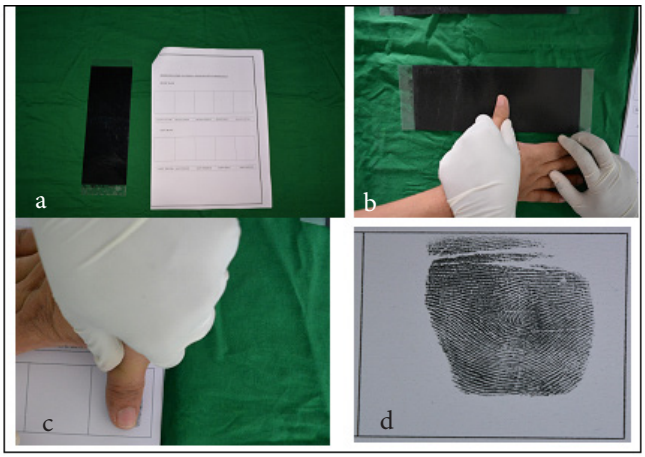


Figure 2. a)Proforma for collection of fingerprints and disposable fingerprint ink strips b) Rolled impression of fingertip obtained on fingerprint ink strip c) Rolled impression of fingertip recorded on preformed A4 paper d) Fingerprint impression.

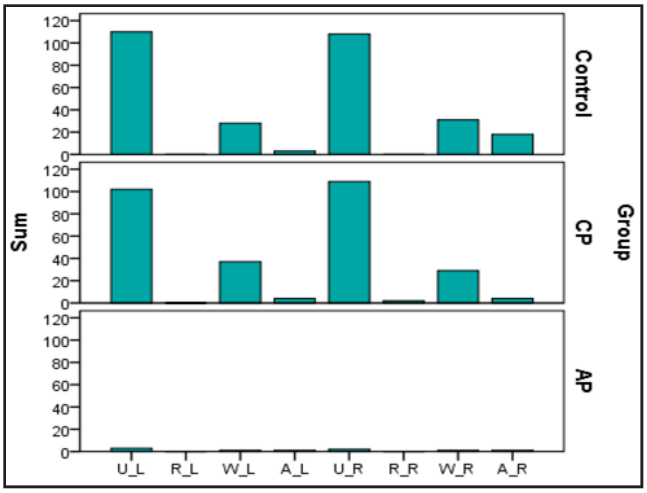


Figure 3. Association of patterns in finger V.

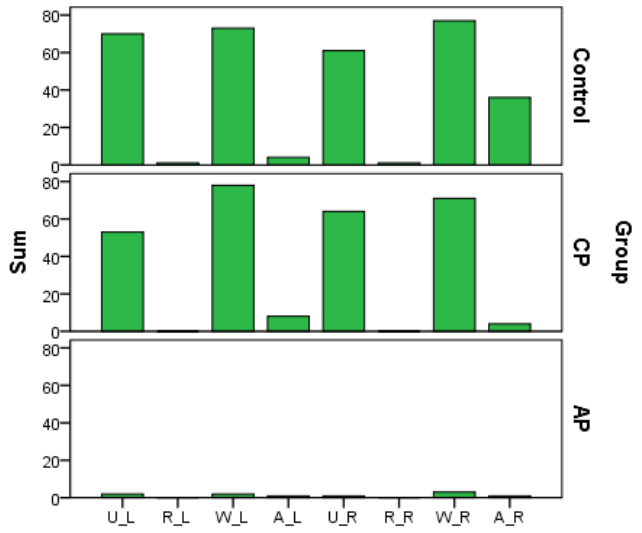


Figure 4. Association of patterns in finger IV.

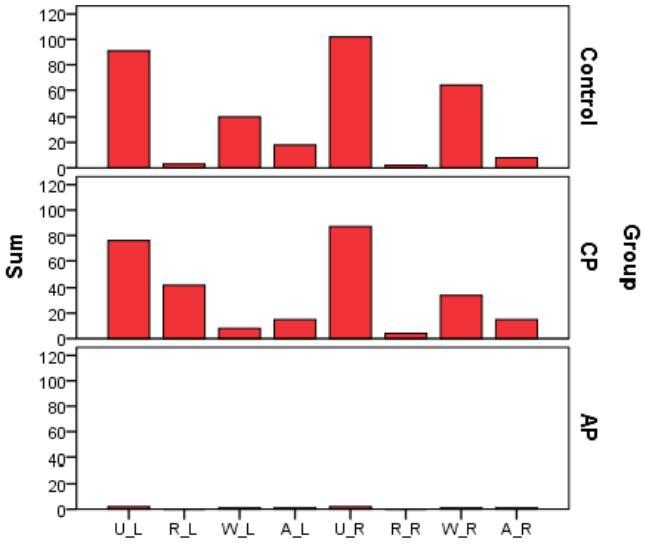


Figure 5. Association of patterns in finger II.

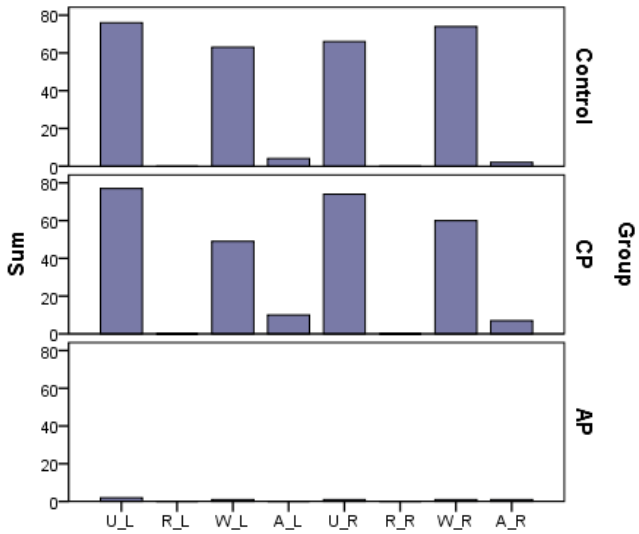


Figure 6. Association of patterns in finger III.

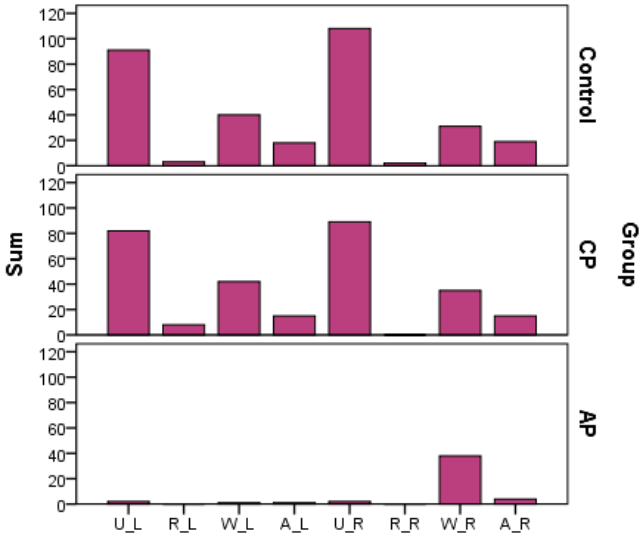


Figure 7. Association of patterns in finger I.

4.2 Association of Patterns in Finger IV

It was observed that for left finger, there is no association of presence of patterns R (p=0.367) and A (p=0.053) with the study groups. For right finger, there is no association of presence of pattern R (p=0.367) with the study groups. For the remaining patterns there is association of presence of patterns with the study groups (p=0.000) (Figure 4).

4.3 Association of Patterns in Finger III

It was observed that for right finger, there is no association of presence of pattern R with the study groups (p=0.132). For the remaining patterns there is association of presence of patterns with the study groups (p<0.05) (Figure 5).

4.4 Association of Patterns in Finger II

It was observed that for right finger, there is no association of presence of patterns R (p=0.134) and W (p=0.625) with the study groups. For the remaining patterns there is association of presence of patterns with the study groups (p<0.05) (Figure 6).

4.5 Association of Patterns for Finger I

It was observed that for right finger, there is association of presence of patterns with the study groups (p < 0.05). For pattern R, the analysis is not done as that pattern is not present in both left and right finger (Figure 7).

Table 1. The patterns for AP group left and right finger

Pattern types	AP	CP	Control
Whorls	0	0	0
Concentric	1	11	7
Symmetric	0	3	11
Central pocket	0	6	8
Spiral	0	20	19
Double loop	2	3	8
Twinned	0	5	6
Accidental	0	0	1
Radial Loops	0	0	0
Vertical	1	6	3
Transversal	0	2	0
Ulnar Loops	0	0	0
Vertical	1	36	44
Transverse	0	39	29
Arches	0	0	0
Plain	1	10	7
Tented	0	0	0

The patterns for AP group are found very low for both left and right finger (Table 1).

5. Discussion

Since past three decades, the significance of skin-ridge patterns has been dealt with in over four thousand papers. Ample research has also been done on the dermatoglyphic indicators of Alzheimer's disease, congenital heart disease, leukaemia, malignancy, gastrointestinal disorders, and mental illness including schizophrenia[7]. Dermatoglyphics may hence be regarded as a sensitive indicator of intrauterine dental anomalies. Early detection and intervention in children can prevent onset of disease and its progression in adulthood[8].

Studies have investigated the role of Dermatoglyphics in oral diseases such as dental caries, oral cancer, bruxism, and malocclusion, anomalies of teeth, cleft lip, cleft palate, periodontal disease, dental fluorosis and in forensic odontology[9,10-20].

Chronic periodontal destruction caused by the accumulation of local factors: plaque and calculus can occur before age 35 years and aggressive disease seen in young patients may be independent of age but has a familial (genetic) association[21]. Incidence of Aggressive Periodontitis found in a young individual implies that over a relatively short time, considerable destruction has been caused by the causative agents[22]. Given the severity and tendency to progress; early detection of periodontal diseases should be the primary concern of both practitioners and patients.

Hence this study was aimed at determining the association of dermatoglyphics and periodontitis.

In a study, on comparing the dermatoglyphic patterns of the patients with periodontitis compared with those of Periodontally Healthy (PH) individuals, samples from Juvenile Periodontitis (JP) showed reduced frequency of twinned and transversal ulnar loops, the right second digits of the patients with Rapidly Progressive Periodontitis (RPP) demonstrated an increased frequency of radial loops and decreased frequency of double loops on all fingers on and all fingers of the patients with Adult Periodontitis (AP) showed increased frequencies of concentric whorls and transversal ulnar loops. Also an increased frequency of the tri-radii on the palms and soles of the patients with JP were found[23]. Our study revealed, a decrease in double loops in aggressive and chronic periodontitis, whereas this was seen only in rapidly progressive periodontitis by Atasu. An increase in transverse ulnar loop and concentric whorls was seen in chronic periodontitis patients, similar to the findings of Atasu *et al.*

While comparing the patterns of subjects with periodontitis (both chronic as well as aggressive) and healthy patients it was noted that there was no association of radial loops in right II, IV, V digits and left III and IV digits. This is contrary to the findings by Atasu *et al.* who found an increase of radial loops in right II digits in rapidly progressive periodontitis. Also there was no association of arches in left IV and V digits; and no association of whorls in right second digits. Also there is increased incidence of concentric whorls as well as transversal ulnar loops on all the fingers of samples with chronic periodontitis, which is similar to observations made by Atasu *et al.*[23].

Shyamala *et al.* observed the dermatoglyphic patterns of Aggressive Periodontitis patients with that of the control cases (normal persons), to detect the prevalence of a characteristic pattern that can be assigned to be susceptible for Aggressive Periodontitis. Thirty patients (20 to 35 years), under treatment for Aggressive Periodontitis, formed the study group and 30 periodontally healthy individuals were included in the control group. Fingertip patterns were obtained and analysed according to the standard guidelines for classification of patterns. It was concluded that there are

three specific pattern combinations: Absence of ulnar loop normal, absence of ulnar loop variant, presence of double loop whorl, presence of single loop whorl: which can be useful in linking the susceptibility to Aggressive Periodontitis[24].

Whereas in our study, the patterns seen in aggressive periodontitis were: Absence of ulnar loop normal, presence of ulnar loop variant, presence of double loop whorl and absence of single loop whorl.

The assessment of dermatoglyphic patterns by Shyamala *et al.* revealed a decreased frequency of whorls and increased frequency of ulnar loops on all fingers of patients with aggressive Periodontitis[24]. But in the present study, a decrease in both ulnar loops and whorls were noticed in aggressive periodontitis.

In a study by Devishree *et al.*, comparison was done by analysing the finger-tip prints of 15 patients with aggressive Periodontitis and 15 periodontally healthy subjects, which revealed decreased frequency of whorls, an increased frequency of ulnar loops on all fingers of patients with aggressive Periodontitis[25]. In our study, a decrease in both ulnar loops and whorls were noticed in aggressive periodontitis.

Few novel observations were made in this study:

1. An increase in ulnar and radial loops, increase in plain arches but a decrease in doubles loops and symmetric whorls.
2. When comparing the dermatoglyphic patterns of subjects with aggressive periodontitis, with that of chronic periodontitis, it was noted that there was absence of central pocket and symmetric whorls, as well as decrease of transverse radial and ulnar loops.
3. Very low association of patterns was observed on comparing dermatoglyphic patterns of subjects with aggressive periodontitis and healthy controls.

6. Limitations

Limited sample size and population inhabiting a particular geographic area can be considered as drawbacks of our study. The variations in results when compared to the limited research findings available may be due to the differences in the sample population selected which varied in geography and ethnicity. In this study, the sample population selected only had 3 cases of aggressive periodontitis, the type of periodontitis most of the previous research had focused upon. Analysis of the patterns of the palms and the soles rather than the fingertips alone would have given a better insight into the association between health and periodontal disease.

7. Conclusion

With regard to this study comparing the dermatoglyphic patterns of subjects diagnosed as aggressive or chronic periodontitis with that of healthy controls, it may be concluded that, there exists variations amongst certain dermatoglyphic patterns. The observations made in this study were a decrease in double loops in aggressive periodontitis and chronic periodontitis, a decrease in ulnar loops and concentric whorls in aggressive periodontitis and an increase in transverse ulnar loops, symmetric whorls, concentric whorls and plain arches in chronic periodontitis.

This may help in creating a platform for early detection and intervention in susceptible individuals. The usage of dermatoglyphics has advantage that this technique is cost effective, easy and non-invasive. Further research involving larger sample size and diverse population ethnicity is required for conclusive evidence correlating dermatoglyphics and periodontal disease.

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