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Comparative reliability of dermatoglyphics, cheiloscopy and rugoscopy for the predilection of dental caries

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Abstract

Introduction: Genetic susceptibility to dental caries is dependent on certain factors, which if evaluated, can help in estimating disease situation prematurely Aim Aim of the study is to compare the reliability of dermatoglyphic, cheiloscopic and rugoscopic patterns for assessing the risk of dental caries in children.

Materials and methods: A total of 50 children between the age of 5 to 12 years were selected for the study. The sample was divided into Group 1 (n=25) caries free and Group 2 (n=25) caries active group. Grouping was done by recording DMFT/deft index of the children. Finger prints, Lip prints and Rugae pattern were collected from all subjects and analysis of all patterns was carried out followed by a comparison of the patterns with the controls statistically.

Results: There was increase in frequency of whorls and decrease in frequency of loop in caries active group when compared to caries free group. According to cheiloscopic findings branched pattern was more prevalent in caries active and vertical pattern was more prominent in caries inactive group. According to the rugoscopic findings wavy pattern was more prominent irrespective of the deft/ Dmft scores.

Conclusion: Dermatoglyphics, Cheiloscopy and Rugoscopy can hence prove to be extremely useful, non invasive and inexpensive tools for preliminary investigation and early detection of dental caries.

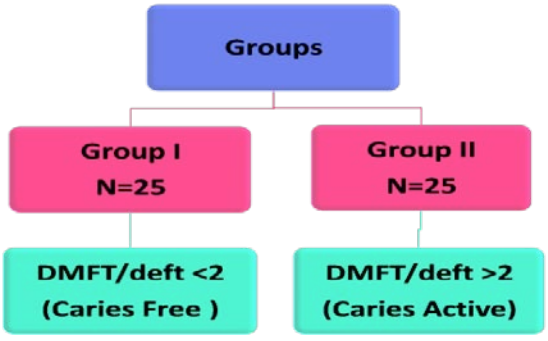
Keywords: Dermatoglyphics, cheiloscopy, rugoscopy, dental caries, gentic pattern.

Introduction

Dental caries is the most prevalent chronic disease seen in children worldwide, and despite advancements in oral healthcare, many adults, and children are still affected. The etiology of dental caries is complex and multi factorial, including environmental and genetic factors. The magnitude of each of these factors contributing to caries can vary significantly on an individual basis. [1] It is the genetics that determines the susceptibility of an individual to develop caries. Lines on the human hands have since long been a subject of interest. The skin of palm and sole has ridges, unique to every individual and has been used for personal identification. Cummins and Midlo defined 'DERMATOGLYPHICS' as the study of the intricate dermal ridge configurations on the skin covering the palmar and plantar surfaces of hand and feet. Etymologically this term is a harmonious blend of two words derma, i.e., skin; and glyphe, i.e., carve, giving the impression that something has been carved out of the skin. The dermal patterns once formed remain constant throughout life [2]. The genesis of the dermal ridges occurs with relation to the volar pads. The dermal ridge appear during the 12th week of the intrauterine life and are completed by the 24th week of intrauterine (I.U) life i.e. the same time as that of tooth formation in intrauterine life. This conveys that the genetic meaning contained in the genome, normal or abnormal, is decoded during this stage and could also be replicated by dermatoglyphics [3]. The ectoderm, from which the epidermis is derived, plays an important role in the configuration of several structures such as the teeth [4]. If an intrauterine dermal damage take place, a tooth anomaly might be expected [5]. Lip prints are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of the human lip between the inner labial mucosa and outer skin. The grooves present on the human lips are unique to each person and can be used to determine identity. The study of these grooves or furrows present on the red part or the vermilion border of the human lips is known as cheiloscopy and it was first noted by anthropologists, R. Fischer who was the first to describe it in 1902 [6]. Palatal rugae, also called plicae palatinae transversae and rugae palatine. They represent the ridges on the anterior part of the palatal mucosa, each side of the median palatal raphe and behind the incisive papilla [7,8]. In human embryos, rugae are relatively prominent and occupy most of the length of the palatal shelves at the time of their elevation [9]. The palatine rugae are permanent and unique to each person and can establish identity through discrimination (via casts, tracings or digitized rugae patterns). The present study was undertaken to compare the reliability between dermatoglyphic pattern, rugae patterns, and cheiloscopic patterns and dental caries, so as to enable early detection of susceptibility of an individual to dental caries by studying its genetic basis by effectively utilizing noninvasive, less expensive, and effective tools that help early prediction of dental caries, thereby limiting the disease from progressing to an advanced stage and preventing further tooth loss.

Materials and Methods

50 children in the age group of 5–12 years were selected for the study. They were divided into two groups:



Caries detection : Teeth were cleaned of any food debris present, with the help of sterile cotton or three-way syringe. "Decayed-extracted-filled teeth" index for primary teeth and "decayed-missing-filled teeth" index for permanent teeth were recorded with the help of blunt-ended right-angle probe (no. 17), shepherd crook probe (no. 23), and Mouth Mirror under good source of light.

Inclusion criteria: Cooperative and apparently healthy children between 5 and 12 years were included in this study.

Exclusion criteria: Uncooperative children, mentally or physically handicapped children, children with developmental anomalies, skin disorders, trauma or any pathology to the fingertips, lips and palate and those allergic to lipstick, ink pad, cellophane tape, and alginate were excluded from the study.

Procedure for thumbprint recording and interpretation: All fingers were cleaned and were pressed on the blue ink stamp pad with gentle pressure followed by placing them on the white bond paper to take their impressions. The prints were examined using a magnifying glass**[Figure 1**], classified, and analyzed by **Cummins method** of fingerprint identification into whorls, loops, and arches.

Figure 1:Ridge pattern with magnifying glass

Loop pattern: A loop is recognized as a series of ridges that enter the pattern area on one side of the digit, recurves abruptly and leaves the pattern area on the same side. A single triradius is present, which is located laterally on the fingertip, where the loop is closed. **[Figure 2]**

Figure 2: Loop pattern

Whorl pattern : A whorl differs from the loop in the aspect of a concentric arrangement of ridges, with two or more triradii in the latter **[Figure 3].**

Figure 3: Whorl pattern .

Arch pattern: Arches show the simplest ridge pattern, which is formed by the succession of one or more parallel ridges, which cross the finger from one side to the other without recurving. These patterns usually do not show the presence of triradii **[Figure 4].**

Figure 4: Arch pattern

Procedure of Lip print recording and interpretation

The lips of the participants were cleaned and lipstick was dabbed evenly over the vermillion border of the lip and participants were asked to rub both the lips to spread the applied lipstick uniformly. After 1 min, the adhesive portion of the cellophane tape was placed over the lips

and then pressed comfortably toward the corners of the lips. The cellophane strip was then stuck to the white bond paper for a permanent record **[Figure 5]**.

Figure 5 : Lip Prints showing vertical pattern

The lip prints were then analyzed by **Tsuchihashi and Suzuki's classification [Figure 6]** using a magnifying glass into:

• Vertical: comprising of complete or incomplete longitudinal fissures/patterns

• Branched: branching Y-shaped pattern

• Intersected: criss-cross pattern

• Reticular: typical chequered pattern, fence-like

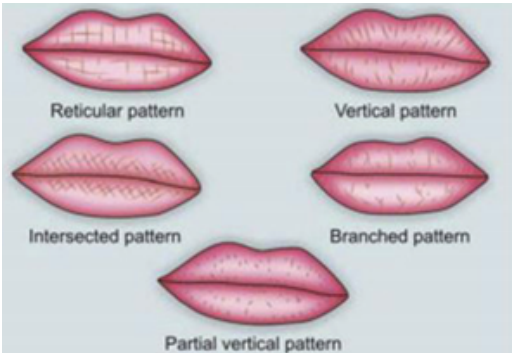


Figure 6 : Tsuchihashi and Suzuki's classification of lip prints

Procedure of palatal rugae pattern recording and interpretation: Impressions of the upper arch of all participants under study were taken using alginate and casts were poured using dental stone [Figure 7].

Figure 7: Marked rugae pattern on he cast

The rugae patterns were studied on the casts and classified based on the **Thomas and Kotze classification [Figure 8].** The rugae were divided into four types based on their shape

1. Curved: They had a crescent shape and curved gently

2. Wavy: If there was a slight curve at the origin or termination of curved rugae

3. Straight: They run directly from their origin to termination

4. Circular: Rugae that form a definite continuous ring.

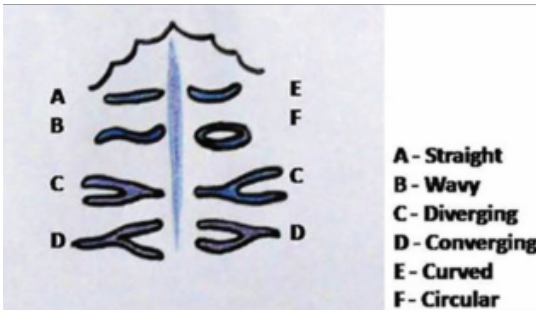


Figure 8: Thomas and Kotze classification of palatal rugae patterns

Results

The present study was carried out to correlate between various patterns of thumbprints, lip print, and palatal rugae patterns with dental caries. A total of 50 children were included in the study. The most common fingerprints

pattern in the children with higher deft scores was whorl pattern (52%) in right and 48% in left thumb, followed by loop 44% % in both right and left thumb and arches 4%

in the right thumb and 8% in the left thumb **[Table 1]**In children with lower deft, loops were more common than whorl pattern.

The branched pattern of lip prints was found to be the most prevalent in children with a higher Dmft/ deft score and vertical pattern was more commonly seen in caries free individual **[Table 2].**

Among palatal rugae shapes, wavy was found to be the most prevalent with 60% of caries inactive and 56% of caries active individual in our study population. **[Table 3].**

Table 1 : Dermal Ridge Analysis

	Group I	Group I	Group II	Group II	p– Value
	Right Thumb	Left Thumb	Right Thumb	Left Thumb	0.7652
Loop Pattern	14 (56%)	14(56%)	11 (44%)	11 (44%)	
Whorl Pattern	9 (36%)	8 (32%)	13 (52%)	12 (48%)	
Arches	2 (8%)	3 (12%)	1 (4%)	2 (8%)	

Table 2 : Lip Print Analysis

	Group I	Group II	p-Value
Branching	6 (24%)	13(52%)	0.03783
Reticular	8(32%)	8(32%)	
Vertical	11(44%)	4(16%)	
Intersected	0(0%)	0(0%)	

Table 3 : Palatal Rugae Analysis

	Group I	Group II	p – value
Wavy	15 (60%)	14 (56%)	.89607
Curved	5 (20%)	6 (24%)	
Straight	3 (12%)	4 (16%)	
Circular	2 (8%)	1 (4%)	

Discussion

Development is the progress towards maturity. In intra-uterine period, these processes are dependent on both genetic and environmental determinants. Growth and development takes place by cytoplasmonuclear interaction [10]. Dental caries is a multifactorial disease of human mankind which is a combination of a variety of factors including environmental and behavioral factors, including dietary behaviors, bacterial flora, fluoride intake and exposures, oral hygiene, salivary composition and flow rate, tooth positional and morphological features, genetic predisposition, and gene by environment interactions.[11] Genetics and environmental forces play a significant role in the development of an individual's fingerprints. The development of dermatoglyphic patterns begins to develop in the 6–7th week of gestation and is complete by the 20–24th week of gestation. The dermal ridges develop in relation to the volar pads, which are formed by the 6th week of gestation and reach a maximum size between 12th and 13th weeks. This means that the genetic message contained in the genome-normal or abnormal is deciphered during this period and is also reflected by dermatoglyphics [12]. In this study, the dermatoglyphic patterns varied significantly among the subjects. The whorl pattern of fingerprint was found to be more prevalent in children having the higher Dmft/deft. The findings of this study found to be similar to the studies conducted by Vijender et al.[13] , Madan et al. [14], and Sengupta et al. [15] which showed a significant change in the dermatoglyphic pattern between the caries and the caries free group and reported frequency of whorls more in caries group and the frequency of loops more in caries free group. The branched pattern of lip prints was seen in 52% of children in caries active and caries inactive showed 44% of vertical pattern, and this was in accordance with the study done by Madhusudan et al. [16] The uniqueness of the lip prints of an individual indicate the role of genetics in the formation of the different patterns of the lip. In our study, no significant relation was found to exist between palatal rugae shapes and dental caries which was in accordance to the study done by Aggarwal M et al [17]. The limitation of the present study could be the small sample size of 50 children .So, more systematic trials on larger sample size should be undertaken in future to assess the role of dermatoglyphics, cheiloscopy and rugoscopy in the predilection of dental caries.

Conclusion

Through this study, we have found cheiloscopy to be a good marker of dental caries among dermatoglyphics, cheiloscopy and rugoscopy. The dermatoglyphics, cheiloscopic, and rugoscopic patterns utilized in the study were effective to study the genetic basis of dental caries. In a developing country like India, they can be noninvasive, inexpensive, and effective tools for predicting dental caries. This early detection can thus help in anticipation of oral health diseases and help to adopt preventive methods at a young age itself.

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