Research Article

Nepal Journal of Health Sciences

Submitted:27/03/2022
Accepted:08/06/2022
Published:25/06/2022

The Study of Palmar and Digital Dermatoglyphics in Congenitally Deaf Patients

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ABSTRACT

Introduction: Dermatoglyphics is the study of dermal ridges and patterns. It is frequently used for the diagnosis of several diseases in human body including congenital deafness. Congenital deafness appears in children and is diagnosed through pathological tests, genetic investigations, or other anatomical measures.

Objective: To establish potential relationship between Dermatoglyphics and identification of congenital deafness.

Methods: Forty congenital deaf male and female patients and forty normal control groups were selected. Observations of dermal patterns in Hypothenar area and III and IV Interdigital areas of both left and right hands were carried out. Results were obtained for the normal control group as well as the congenital deaf patients' group. Results obtained for both males and females were separately analyzed. Z-tests were conducted to assess the statistical significance of the results.

Results: Loop (Radical), Open Field and Arches (Carpal) were present in higher frequencies in congenital deaf patents compared to the normal control group. The frequency of arches in Hypothenar area in both hands of congenital deaf patients is found to be significantly higher than in the normal control group. Pattern frequencies in III and IV Interdigital area are consistently higher in congenital deaf patients than in the normal control group. Observation of overall pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients exhibit higher frequencies in congenital deaf patients' group.

Conclusions: Dermatoglyphics can be used for the diagnosis of congenital deafness.

Keywords: Congenital deaf; dermatoglyphics; pattern distribution.

INTRODUCTION

Dermatoglyphics is the study of ridges and patterns present on the epidermal layer of volar skin of fingers, palms and soles.[1] Dermatoglyphics, in combination with different clinical procedures, has been used as a diagnostic tool to study ailments in human body. Dermatoglyphics has been used for the detection of dental disorders. [2] Dermatoglyphics has also been used for the detection of congenital deafness. [3,4]congenital deafness may be linked with pattern of palmar\nridges, which is associated with many genetic diseases and congenital\ndefects.\nMATERIALS AND METHODS\nDigital patterns, digital counts, total finger ridge count (TFRC

Congenital deafness is apparent in many children after birth. It has been extensively studied using anatomical and pathological procedures.[5] Genetic analysis is successful in determining about 50 % of childhood hearing disabilities. [6] Development of dermal ridges is associated with the development of inner ear as these features develop contemporaneously during intrauterine life.

Hypothenar and Interdigital areas are areas on palms where observations of patterns can be made.

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Citation

Baral P, Manandhar S, Yadav P, Jha CB. The Study of Palmar and Digital Dermatoglyphics in Congenitally Deaf Patients. Nepal J Health Sci. 2022 Jan-Jun; 2(1): 41-5.

Dermatoglyphics is a simpler approach compared to the complex pathological analyses and genetic investigations. Dermatoglyphics could be a promising technique for early diagnosis of diseases in human body.

This study applies Dermatoglyphics to study the congenital deaf patients visiting BPKIHS and aims to conclude whether Dermatoglyphics could be an effective diagnostic tool to explain the existence of congenital deafness in male and female patients.

METHODS

The study was carried out as a cross sectional study. Approval for the study and its procedures was received from the Institutional Review Committee (IRC), B.P. Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal.

For this study, a total of 80 participants were selected. The 80 participants included both congenital deaf patients and the normal control group. The total of 80 participants was divided into 4 groups with 20 participants in each group. The 4 groups were categorized as Congenital deaf (male), Congenital deaf (female), Normal control group (female) and Normal control group (male) (Table 1).

The first group termed as 'Congenital deaf (male)' consisted of 20 male patients who were congenitally deaf and visited BPKIHS for their treatment. The second group termed as 'Congenital deaf (female)' consisted of 20 female patients who were congenitally deaf and visited BPKIHS for their treatment. The third group termed as 'Normal control group (female)' consisted of 20 females who were normal and without congenital deafness. The fourth group termed as 'Normal control group (male)' consisted of 20 males who were normal and without congenital deafness. Only those congenitally deaf patients who were attending the OPD of BPKIHS were considered in this study. It was also taken into consideration that the age range for the congenital deaf patients' group and the normal control group for both males and females were similar.

Initially, dermal patterns on the right hand and left hand of all 80 participants were recorded using printer ink and paper. The palm was divided into thenar, hypothenar and III and IV interdigital areas. Presence or absence of patterns in these areas was analyzed and recorded.

In the beginning, frequency distribution of patterns in Hypothenar area of the control group (both male and female), and congenital deaf patients (both male and female) under consideration were separately observed. The left hand as well as right hand were separately analyzed for this experiment. The types of patterns that were taken into consideration were Loop (Ulnar), Loop (Radical), Loop (Carpal), Open field, Arches (Carpal), Whorls and Vestiges. Finally, the frequencies of these patterns in left hand and right hand of congenital deaf patients and the normal control group were recorded and analyzed.

In the next stage, frequency distribution of arches in Hypothenar area on both hands of males and females of both control group and congenital deaf patients under consideration was recorded and analyzed. For this purpose, presence of arches in Hypothenar area on both hands and not just one hand was considered.

Table 1: Population of congenital deaf patients and normal control group under consideration in this study.

Population Category	Number
Congenital deaf (male)	20
Congenital deaf (female)	20
Normal control group (female)	20
Normal control group (male)	20

In addition, Z-test values were computed for the results to understand the statistical significance of the results obtained.

Pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients under consideration were recorded and analyzed. For this purpose, pattern frequencies in left hand and right hand were separately recorded. Z-test values were computed for the results to understand the statistical significance of the results obtained.

Overall pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients under consideration were recorded and analysed. In addition, Z-test values were computed for the results to understand the statistical significance of the results obtained.

RESULTS

The Hypothenar area observation showed the frequency of Loop (Ulnar) was lower in both left and right hands of congenital deaf patients when compared to the normal control group (Table 2).

Loop (Carpal) was absent in control group as well as congenital deaf patients in both left and right hands. Frequencies of Open field and Arches (Carpal) were much higher in congenital deaf patients when compared to the normal control group in both left and right hands.

The observation of arches in Hypothenar area indicated that frequency of arches in Hypothenar area was much higher in congenitally deaf males and females than the normal control population of males and females. (Table 3). The Z-test values indicated that the results obtained was statistically highly significant for males and statistically significant for females.

Pattern frequencies in III and IV Interdigital area showed the frequencies were higher in congenital deaf males and females when compared to the normal control group. The frequencies were higher in both left and right hands of congenital deaf patients.

Table 2: Frequency distribution of patterns in Hypothenar Area of the control group (both male and female) and congenital deaf patients (both male and female) under consideration.

Type of pattern	Left hand		Right hand	
	Controls	Deaf	Controls	Deaf
Loop (Ulnar)	11	7	8	4
Loop (Radical)	6	14	3	12
Loop (Carpal)	0	0	0	0
Open field	7	18	11	21
Arches (Carpal)	9	26	8	27
Whorls	0	0	0	1
Vestiges	0	0	0	1

Table 3: Frequency distribution of arches in Hypothenar area in both hands of males and females of control group and congenital deaf patients under consideration.

Population Category	Males	Females
Controls	3	3
Deaf	14	9
Values after Z-test	3.51 (h.s.)	2.07 (s.)

Here, (s) indicates that Z-test value is significant ($p < 0.05$) and (h.s.) indicates that Z-test value is highly significant ($p < 0.01$).

Table 4: Pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients under consideration.

Population Category	III Interdigital area				IV Interdigital area			
	Males		Females		Males		Females	
	Right	Left	Right	Left	Right	Left	Right	Left
Control	6	3	7	2	7	5	5	4
Deaf	13	6	10	10	10	14	6	8
Values after Z-test	2.216 (s.)	1.135 (n.s.)	0.959 (n.s.)	2.76 (h.s.)	0.959 (n.s.)	2.849 (h.s)	0.354 (n.s.)	1.38 (n.s.)

Here, (s.) indicates that Z-test value is significant ($p < 0.05$), (h.s.) indicates that Z-test value is highly significant ($p < 0.01$) and (n.s.) indicates that Z-test value is not significant ($p > 0.05$).

Table 5: Overall pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients under consideration.

	IIIrd Interdigital area		IVth Interdigital area	
	Males	Females	Males	Females
Control	9	9	12	9
Deaf	19	20	24	14
Values after Z-test	2.34 (s.)	2.55 (s.)	2.69 (h.s.)	1.23 (n.s.)

Here, (s.) indicates that Z-test value is significant ($p < 0.05$), (h.s.) indicates that Z-test value is highly significant ($p < 0.01$) and (n.s.) indicates that Z-test value is not significant ($p > 0.05$).

However, Z-test values indicated that most of the results were statistically not significant. Results were highly significant for III Interdigital area only in case of left hand of female population. Similarly, results were highly significant for IV Interdigital area only in case of left hand of male population.

Observation of the overall pattern frequencies in III and IV Interdigital area of males and females of both control group and congenital deaf patients showed that these patterns were consistently higher for both congenitally deaf male as well as female patients. The Z-test further revealed that the results obtained for IIIrd Interdigital area were statistically significant.For IVth Interdigital area, the results obtained in case of male was statistically highly significant whereas the results obtained for female was statistically not significant.

DISCUSSIONS

There are multiple studies focused on the use of Dermatoglyphics for early diagnosis of congenital deafness. A study focused on Dermatoglyphic signs in 535 patients with congenital deaf-mutism[7] concluded that these signs could be significant for understanding different forms of deaf-mutism. Another study carried out with 100 normal children and 100 congenital deaf children [8], also supported the fact that Dermatoglyphics could be used as a diagnostic tool in detection of deaf patients.

Qualitative analysis of another study [4] concluded an increase in frequency of arches whereas a decrease in the frequency of whorls in case of congenital deaf patients thus establishing the relationship between dermal patterns and congenital deaf patients.

A recent study observed the digital patterns and finger ridge counts and found out that differences existed in Dermatoglyphic patterns in deaf patients when compared to controls.[3] The study proposed that Dermatoglyphics could be clinically essential in early discovery of congenital deafness. Another recent study[9] carried out in South East Nigeria made a comparison between normal control group and deaf patients. The study found out that the frequency of Loop (Ulnar) was the highest while the Loop (Radial) was the lowest in the control groups as well as the deaf patient group and this condition was prevalent in both hands of males and females.

Several studies in the past have demonstrated successful application of Dermatoglyphics for the early detection of congenital deafness. This study also suggests that Dermatoglyphics can be used as a significant tool for the study of congenital deafness. However, this study has been affected due to its small sample size. Additionally, this study focuses on a small number of patients attending BPKIHS only. A larger population of congenital deaf patients considered from different places within Nepal could be useful in making stronger inferences regarding the relationship between deafness and Dermatoglyphics. A larger dataset would be essential for conducting different statistical analyses and therefore, would be useful in building confidence in the results obtained from the analyses. Nevertheless, this study supports the fact that study of dermal patterns could be critical in the diagnosis of congenital deafness.

CONCLUSIONS

The present study confirmed the applicability of Dermatoglyphics in the study of congenital deafness and supports the fact that study of dermal patterns could be critical in the diagnosis of congenital deafness.

Conflict of Interest: None

NJHS

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