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Original Research Article

Dermatoglyphic palmar pattern variations in congenitally deaf and mute subjects

Rimple Bansal, Ruchi Goyal*, Usha Chhabra, Harsimarjit Kaur, Gurdeep Singh Kalyan

Department of Anatomy, Government Medical College and Rajindra Hospital, Patiala, Punjab, India

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***Correspondence:**
Dr. Ruchi Goyal,
E-mail: dr.roochie@yahoo.com

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ABSTRACT

Background: Dermatoglyphics have the unique merit of retaining all their peculiarities unchanged throughout life, and afford in consequence an incomparably surer criterion of identity than any other bodily feature. The rationale for studying dermatoglyphic features is derived from the fact that development of dermal ridges and congenital deafness seems to develop at around the same time.
Methods: The material for the study consisted of palm prints of congenitally deaf and mute children of 100 subjects with congenital deafness and muteness between 5-21 years of age and 50 control of similar age group with normal hearing and speech were chosen. The principal patterns of thenar/interdigital I, interdigital II, interdigital III, interdigital IV and hypothenar area were noted. Position of axial triradius, 'atd' angle, pattern of palmar Flexion Creases, presence as well as pattern of the Simian Line and the Sydney Line were recorded.
Results: The percentage of open field was maximum in subjects in thenar/interdigital area I. and in interdigital area IV. The mean a-b, c-d and atd angle ridge palmar ridge count was less in subjects in comparison to controls. Highly statistically significant results were obtained between subjects and control for the simian crease pattern when both hands were considered together in which the percentage of transitional type was more than the typical simian crease in subjects.
Conclusions: When combined with other clinical and investigative features, dermatoglyphic study can serve as a diagnostic impression and can be advocated as a useful screening device.

Keywords: Palmar pattern, Congenitally deaf and mute, Dermatoglyphics

INTRODUCTION

Dermatoglyphics have the unique merit of retaining all their peculiarities unchanged throughout life, and afford in consequence an incomparably surer criterion of identity than any other bodily feature.[1] They may be made to throw welcome light on some of the most interesting biological questions of the day, such as heredity, symmetry, correlation, and the nature of genera and species. There is no prejudice to be overcome in procuring these most trustworthy sign-manuals, no vanity to be pacified, no untruths to be guarded against.[2] Palmar creases develop during the 2nd and 3rd month of intrauterine life and are not influenced by movement of hand in utero.[3] Factors such as inadequate oxygen supply, unusual distribution of sweat glands and alterations of epithelial growths could influence ridge patterns. Dermatoglyphics of many conditions like schizophrenia

(decreased frequency of patterns in the right fourth interdigital area), Down's syndrome (presence of simian crease, Sydney line), diabetes mellitus (high TRC), hypertension (lower frequency of fingertip ulnar loops, higher frequency whorls and a higher total finger ridge count) have been studied in the past. Dermatoglyphics is considered as a window of the congenital abnormalities and is sensitive indicator of intrauterine anomalies.[4]

The rationale for studying dermatoglyphic features is derived from the fact that development of dermal ridges and congenital deafness seems to develop at around the same time as cochlear anatomy which is grossly mature by 22-26 fetal weeks[5] and fingerprint patterns are complete by twenty-first week of fetal life.[6] Hence, the relevance of dermatoglyphics is not to diagnose or for defining an existing disease, but to identify people with the predisposition to develop certain diseases.[7] Hearing impairment can have a major impact on the social and emotional development as well as behavioral and academic achievement. The earlier the impairment is identified the better the prognosis. The present study is aimed at determining variations in the palmar dermatoglyphic patterns associated with congenital deaf subjects as compared to the normal controls.

METHODS

The material for the cross- sectional study consisted of finger and palm prints of congenitally deaf and mute children (as per medical records submitted to the institute at the time of admission) of Patiala School for The Deaf, Patiala. 100 subjects (50 males and 50 females) with congenital deafness and muteness between 5-21 years of age and 50 control (25 males and 25 females) cases of similar age group with normal hearing and speech were chosen for the study. Study period extended from February, 2012 to November, 2013. Subjects having any other congenital abnormalities and the cases of acquired deafness were excluded from the study. "Printer's ink and paper method" was used for recording the prints.

The procedure was explained to the subjects so that they could cooperate. Hands of the subject were thoroughly washed with soap and water and dried with napkin before taking prints. Inking slab was cleaned to avoid any interference of accumulated dust etc., in taking good prints. Then requisite amount of ink was poured on a clean slab and ink was evenly spread on the glass slab by a cotton pad. This thin uniform film of ink was transferred on the fingers of the subject with the help of this cotton pad from the end of the terminal phalanx to the flexion crease of distal interphalangeal joint. Uniform thin layer of ink was applied on the palms of the subject with the help of the ink saturated cotton pad. Then this inked palm was placed on the paper having a pad beneath it for better contact of the hollow of the palm with the paper. Requisite pressure was applied on the knuckles, interdigital areas and hollow of the palm in order to get the clear print.

The same procedure was adopted to obtain the palm prints of the controls. A magnifying hand lens was used to magnify the ridges of the prints for easy identification of the different finger print patterns. The obtained palm prints of both hands were analysed qualitatively and quantitatively. The principal patterns (whorl, loop, a vestige or an open field, tented arches) were noted. The configurations of thenar and I interdigital areas were closely related anatomically. The configurational area lying between digital triradii 'a' and 'b' was interdigital II, that between triradii 'b' and 'c' was interdigital III, and area between triradii 'c' and 'd' was interdigital IV. Hypothenar loops had three instead of two directions of opening: the radial margin, the ulnar margin, the proximal (carpal) margin. Four 'digital triradii' located in proximal relation to the bases of digits II, III, IV and V (in radioulnar sequence they were named a, b, c and d). Ridge Count between a-b, b-c and c-d were recorded (Figure 1).

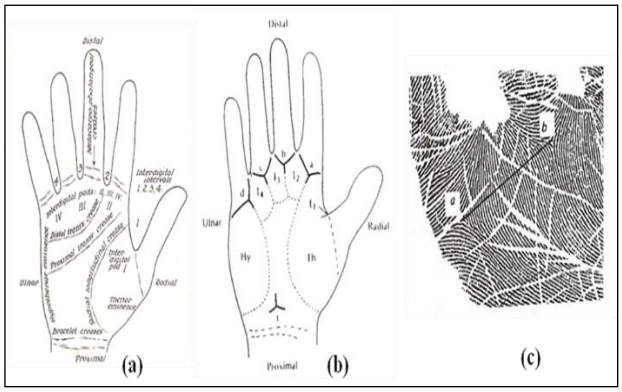

Figure 1: (a) Normal palmar flexion creases, (b) Dermatoglyphic palmar pattern areas, (c) Ridge Count between a-b.

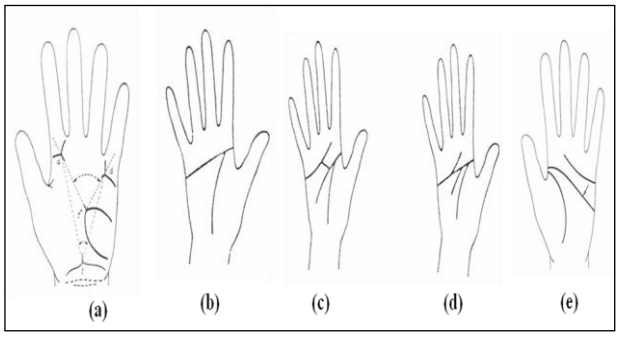

Figure 2: (a) Position of axial triradius (t, t" and t') and 'atd' angle, (b) typical simian crease, (c&d) Transitional Simian Creases, e) Sydney line.

Position of axial triradius (t), near the center of the palm (t") and halfway in between these two positions (t') were recorded. 'atd' (angle made by connecting the 'a', 't' and 'd' triradii points on the palm) were recorded. If more than one axial triradius is present, the most distal one was used in the analysis. Pattern of palmar Flexion Creases (distal

transverse, proximal transverse and radial longitudinal) based on common point of origin as single radial base crease (SRBC), double radial base crease (DRBC) or triple radial base crease (TRBC) was noted. Presence as well as pattern of the Simian Line and the Sydney Line were recorded (Figure 2). Data analysis was done using mean, standard deviation and chi square test (x^2) for the data of subjects as well as controls.

RESULTS

Pattern of thenar/interdigital area I, Interdigital Area II, Interdigital Area III, Interdigital Area IV, Hypothenar Pattern and palmar flexion creases of both hands were recorded (Figure 3).

On comparing the pattern of thenar/interdigital area I, statistically significant results were obtained between subjects and control when right and left hands were considered together in which the percentage of open field was maximum in subjects. Comparing the pattern of interdigital area IV statistically significant results were obtained in left hand of female subjects in comparison to control in which the percentage of open field was maximum.

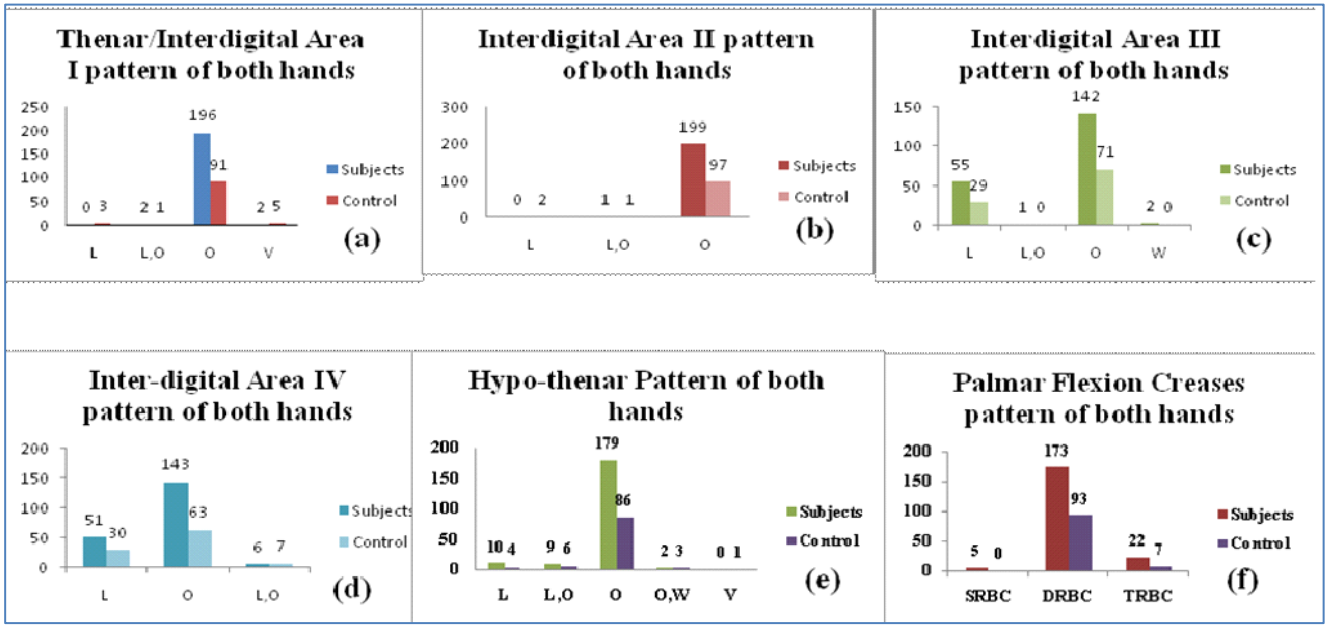

Figure 3: Pattern of; (a) thenar/interdigital area I, (b) Interdigital area II, (c) Interdigital area III, (d) Interdigital area IV, (e) Hypothenar pattern, (f) Palmar flexion creases of both hands.

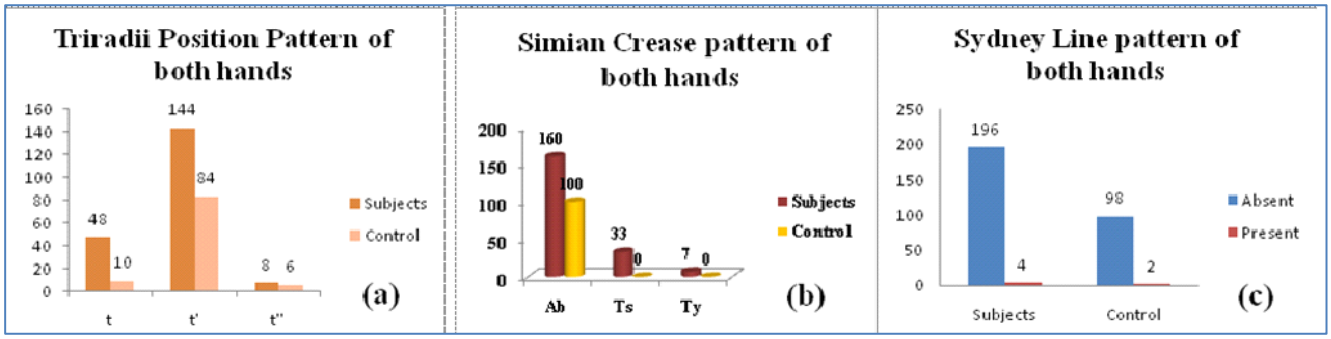

Figure 4: Pattern of; (a) Axial triradius, (b) Simian crease; Ty-Typical, Ts-Transitional, Ab-Absent, (c) Sydney line.

On comparing the palmar ridge count, mean a-b and c-d ridge count was less in subjects in comparison to controls when left and right hand were considered together of subjects and control (Table 1). Comparing the atd angle, the mean of atd angle was less in subjects in comparison to control when both the hands were considered together (Table 2). Comparing the pattern of triradii position, when both the hands were considered together statistically significant results were obtained between subjects and control for pattern of triradii position in which t' position was maximum followed by t and least were the t'' triradii position (Figure 4a). On Comparing the pattern of simian crease, statistically significant results were obtained in left hand of female subjects in comparison to control in which transitional simian crease

were more in subjects and were absent in control females. In the right hand, statistically significant values were obtained between subjects and control females and males in which transitional forms were more than typical simian crease in both the sexes of subjects.

Table 1: Palmar ridge count.

Parameters	Group	N	Mean	SD	SEM	P value
Total ridge count a-b	Subjects	97	70.3814	10.27177	1.04294	0.331
	Control	49	72.2449	12.03386	1.71912	
Total ridge count b-c	Subjects	90	45.6444	9.98011	1.05200	0.915
	Control	45	45.4444	10.80941	1.61137	
Total ridge count c-d	Subjects	90	56.7444	10.83332	1.14193	0.060
	Control	45	60.6222	11.93408	1.77903	
Total ridge count	Subjects	90	173.1444	23.68262	2.49637	0.249
	Control	45	178.4000	27.04323	4.03137	

Table 2: Atd angle.

Parameters	Group	N	Mean	SD	SEM	P value
Atd angle left hand	Subjects	100	41.870	5.8924	.5892	0.582
	Control	50	42.420	5.4514	.7709	
Atd angle right hand	Subjects	100	42.330	6.9994	.6999	0.696
	Control	50	42.800	6.8034	.9621	
Atd angle total	Subjects	100	84.2000	12.34848	1.23485	0.622
	Control	50	85.2200	10.96244	1.55032	

Statistically significant results were obtained between subjects and control of left and right hand when considered separately. Highly statistically significant results were obtained between subjects and control for simian crease pattern when both hands were considered together in which the percentage of transitional type was more than the typical simian crease in subjects (Figure 4b). Similarly, pattern of Sydney line was recorded in both subjects and control (Figure 4c).

DISCUSSION

Statistically significant results were obtained between subjects and control for thenar/interdigital area I pattern when right and left hands were considered together in which the percentage of open field was maximum in subjects. In the present study no statistically, significant results were obtained in the pattern of interdigital area III of subjects and control of females and males of left and right hand. This was in contrast to the findings of Sharma et al who found highly statistically significant results for pattern frequencies of interdigital area III in left hand of deaf females and also statistically higher pattern frequencies in interdigital area III of right hand of deaf males than normal hearing males.[8] In the present study statistically significant results were obtained in the pattern of interdigital area IV of female subjects in left hand in comparison to control in which the percentage of open field was maximum. No statistically significant results were obtained in the pattern of the interdigital area IV of the subjects and in the control males of the left hand. This finding contradicts Sharma et al. who found highly statistically significant values for interdigital area IV pattern in left hand of deaf males when compared with control group.[8]

Present study showed no statistically significant results in the hypothenar pattern of female and male subjects and control of left and right hand. This finding was in contrast to Sharma et al. who reported statistically significant results for pattern frequencies in deaf and control males for right hands hypothenar pattern.[8] No statistically significant results were obtained for a-b ridge count when the left and right hand were considered together of the subjects and control however the mean ridge count was less in the subjects in comparison to the control. The results of the present study coincide with the Alter and Shulenberg who found reduced a-b ridge count in rubella damaged individuals whereas Borate et al showed increase in a-b ridge count in the congenitally deaf cases as compared to normal.[9,10] In the present study, when both the hands were considered together statistically significant results were obtained between subjects and control for pattern of triradii position in which t' position is maximum followed by t and least are the t'' triradii position. Hence the present study contradicts Borate et al who reported increased frequency of high axial triradii.[10] Analysis between the subjects and control for the palmar flexion creases pattern when both the hands were considered together revealed no statistically significant results whereas Yongchun et al noted lower frequency of

the normal type of the palmar creases in the deaf mutes than the normal group.[11]

In the present study statistically, significant results were obtained in left hand of female subjects in comparison to the control in which transitional simian crease were more in subjects and were absent in control females while no statistically significant results were obtained between subjects and control males in left hand for the simian crease pattern. This finding partially coincides with Sharma et al who noticed higher incidence of simian crease in left hand of both sexes in deaf as compared to normal.[8] Highly statistically significant results were obtained between subjects and control for simian crease pattern when both hands were considered together in which the percentage of transitional type was more than the typical simian crease in subjects. This finding coincides with the findings of Alter and Shulenberg and Dar and Winter who reported higher frequency of transitional form of simian crease though Anoop and Manjunath and Borate et al noticed increased frequency of the simian crease.[9-13] In the present study, no statistically significant results were obtained in the pattern of Sydney Line between subjects and control females and males of left and right hand. This finding was in contrast to the findings of Smith et al. who demonstrated increased frequency of the atypical palmar crease (Sydney Line) in the female patients with the congenital rubella.[14] Dermatoglyphics can serve as an uncomplicated, economical screening tool.[15]

Limitations

From the above study it can be concluded that dermatoglyphics can serve as a simple, inexpensive screening tool but further preliminary investigations are needed to come to a conclusive finding.

CONCLUSION

The mean of atd angle was less in subjects in comparison to control, statistically significant transitional simian crease was present in left hand of female subjects, in the right hand, statistically significant transitional forms were more than typical simian crease in both the sexes of subjects. When combined with other clinical and investigative features, dermatoglyphic study can serve as a diagnostic impression and can be advocated as a useful screening device.

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