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Research Article

Abnormal Palmar Flexion Creases (APFCs) and Autism: A Dermatoglyphic Investigation

Biswarup Dey[1*], Diptendu Chatterjee[1], Piyali Das[2], Arup Ratan Bandyopadhyay[1]

[1]Department of Anthropology, University of Calcutta, Kolkata, India; [2]Department of Anthropology, Dinabandhu Mahavidyalaya, Bongaon, India

ABSTRACT

The clinical markers for a variety of neurodevelopmental diseases and chromosomal abnormalities include dermatoglyphic features. In the first and second trimesters of pregnancy, the ectodermic layer is where dermatoglyphic patterns and neural tissues begin to take shape; at this point, the environment has little impact on them. Autism is a complicated neurodevelopmental condition marked by severe behavioral, social, and communication functioning problems. In the Bengalee population of West Bengal, India, the present study aimed to comprehend the connection between Abnormal Palmar Flexion Creases (APFCs) and autism. The standard ink and roller method was used to collect the bilateral palm prints of 100 participants-67 males and 33 females-diagnosed as autistic and 100 participants-55 males and 45 females-who were healthy controls-for this purpose from the Bengalee linguistic groups of West Bengal. The findings showed that the left and right hands of autistic males and females had significantly ($p<0.05$) more APFCs, single transverse creases, and Sydney line than did control males and females. The current study revealed that compared to controls without sex or side differentiations, autistic patients have more Sydney lines and single transverse creases. The results of the current investigation proposed that new early diagnostic criteria for autism may include the obvious existence of APFCs.

Keywords: Abnormal Palmar Flexion Creases (APFCs); Diagnostic and Statistical Manual (DSM); Autism

INTRODUCTION

Dermatoglyphics is the scientific way to classify and measure the cutaneous ridges that occur between the seventh and the twenty-fourth week of intrauterine life on the volar side of fingers, palms, and soles [1,2]. Dermal ridges and ridge patterns are age-independent, long-lasting, and highly heritable physio-morphic features. The method for using dermatoglyphics as a noninvasive tool for identifying clinical syndromes was developed in the 1930s and later developed in tandem with advances in multi-variable data summarization. Cummins was able to accurately identify 90% of those who were affected by the condition using the dermatoglyphic anomalies indicative of the syndrome in 1937, two decades before Lejeune found the chromosomal defect of Down's syndrome [3]. Certain features of skin development, such as similar ectodermal origin and fast growth, are shared between cerebral and epidermal tissues [4-6]. The connection between fetal stress and the alteration of the dermatoglyphic patterns is widely established [7]. In order to ascertain the connection between unusual dermatoglyphic traits and genetic and chromosomal aberrations like Trisomy 21 or Down's syndrome [8-12], Turner's syndrome [5,11], and Klinefelter's syndrome [13], numerous dermatoglyphic studies have been carried out by researchers worldwide.

A complex neurodevelopmental disorder with a strong hereditary foundation is autism [14]. The development of modern genetics and biomedicine revealed that chromosomal rearrangements on the 15q11-15q13 regions [15,16], as well as four overlapped regions on chromosomes 2q, 7q, 16p, and 19p

Correspondence to: Biswarup Dey, Department of Anthropology, University of Calcutta, Kolkata, India, E-mail: biswa.anth@gmail.com

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[17], as well as potential susceptibility regions on chromosome 15 (15q11-q15), were linked to Autism Spectrum Disorders (ASDs). In addition, several loci for autism susceptibility have been identified on chromosome 7's long distal arm (7q) [18,19], including the RELN protein on 7q22 and the *MET* gene on 7q31 [16,18-20]. However, a *SHANK3* gene mutation (located on chromosome 22q13) and an X-linked neuroligins mutation [21] were connected to autism spectrum disorders' socialization and linguistic difficulties. Around age two to three, a core set of symptoms for this complex brain disorder appears, including delayed or nonresponding to people, delays in language development, and repetitive or stereotyped activities [22]. According to what we know about autism in history, the symptoms are present across all cultures and times as well. The symptoms evolve over the course of a child's development and into adulthood, with some indicators disappearing and others emerging [23]. According to the Epidemiology of ASDs, there are 7.6 million Disability-Adjusted Life Years (DALYs) and a prevalence of 1 in 160 worldwide. Additionally, 0.3% of the disease's burden is concentrated in the World perspective. Nevertheless, the prevalence rate of autism has risen in India over time, reaching 1 in 250 between 2008 and 2012 with a 4:1 male-to-female ratio [23,24]. In contrast, research published in 2017 indicated that the prevalence of ASD in India fell between 0.15% and 1.01% of the population [25,26]. In addition to these, 1 in 125 children aged 3-6 years and 1 in 85 children aged 6-9 years were reported to have ASD in 2018 [27]. A different study from the rural sector found that the prevalence rate was 0.11 among children aged 1 to 18 and 0.09 among urban children aged 0 to 15 [28]. According to a study conducted in Chandigarh, 2.25 out of every 1000 children aged 1.5 to 10 had autism [29]. Numerous dermatoglyphic studies on autism have been conducted, and they have been supported by a strong genetic background [14,30-37]. The present study aimed to understand the relationship between Abnormal Palmar Flexion Creases (APFCs)-Single Transverse Creases, and Sydney line among autistic individuals from the Bengali-speaking groups of West Bengal in India.

MATERIALS AND METHODS

To achieve the current purpose, 100 participants-67 males and 33 females-with a clinical diagnosis of autism (according to the DSM-IV-TR-American Psychiatric Association, 2000) and 100 controls-55 males and 45 females-without a history of autism in their families-were selected from among the Bengalee population of Kolkata, West Bengal, India. All the bilateral palm prints were taken using the standard ink and roller method [1] and they were then categorized using system. Sydney lines and single transverse creases were included as a measure of APFCs for the current purpose. In SPSS (version 18.0), all of the datasets were interpreted and examined [3]. Cut-off values were set as p=0.05. The present study got the Institutional Ethical Clearance from the 'Institutional Ethical Committee for Bio-Medical and Health Research involving Human Participants, University of Calcutta' vide Reference No. 06/ET/19-20/1742, dated 14.06.2019. When applicable, the parents and the Autism management center's authority were given prior verbal and written consent. Anonymity was strictly followed for all the participants (Figure 1).

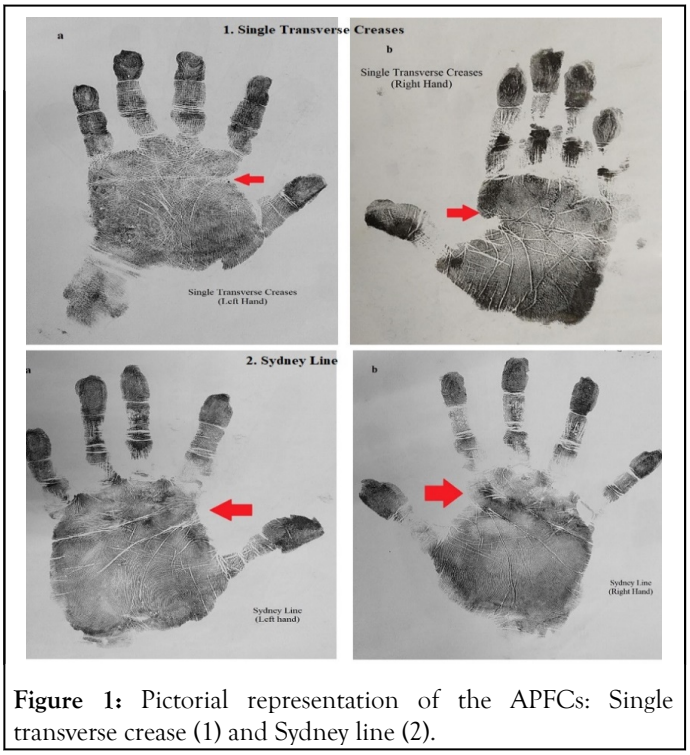

Figure 1: Pictorial representation of the APFCs: Single transverse crease (1) and Sydney line (2).

RESULTS

Table 1 demonstrated the significant ($p<0.05$) presence of the single transverse creases and Sydney line on the left and right hands of the autistic male patients in comparison to the control males. However, Table 2 revealed a significant ($p<0.05$) occurrence of the single transverse crease and Sydney line on the left and right hand of the autistic female patients than that of control females. Nevertheless, Table 3 of the present study suggests a significant ($p<0.05$) association between APFCs (single transverse creases and Sydney line) and autism while combining both hands as well as both sexes than that of the controls.

Group	Normal flexion creases (%)	Single transverse creases (%)	Sydney line (%)	x^2 value (2 df)
Autistic male left hands (n=67)	34 (50.75)	12 (17.91)	21 (31.34)	26.032*#
Control male left hands (n=55)	51 (92.73)	0 (0.00)	4 (7.27)	

Autistic male right hands (n=67)	35 (52.24)	12 (17.91)	20 (29.85)	26.968*#
Control male right hands (n=55)	52 (94.55)	0 (0.00)	3 (5.45)	

Note: *p<0.05; #: Yate's correction, df: degrees of freedom.

Table 1: Distribution of the palmar flexion creases among the autistic males and control males.

Group	Normal flexion creases (%)	Single transverse creases (%)	Sydney line (%)	x^2 value (2 df)
Autistic female left hands (n=33)	17 (51.52)	4 (12.12)	12 (36.36)	21.062*#
Control female left hands (n=45)	43 (95.56)	0 (0.00)	2 (4.44)	
Autistic female right hands (n=33)	17 (51.52)	5 (15.15)	11 (33.33)	21.152*#
Control female right hands (n=45)	43 (95.56)	0 (0.00)	2 (4.44)	

Note: *p<0.05; #: Yate's correction, df: degrees of freedom.

Table 2: Distribution of the palmar flexion creases among the autistic females and control females.

Group	Normal flexion creases (%)	Single transverse creases (%)	Sydney line (%)	x^2 value (2 df)
Autistic patients (n=200)	103 (51.51)	33 (16.5)	64 (32.00)	95.782*#
Controls (n=200)	189 (94.6)	0 (0.00)	11 (5.4)	

Note: *p<0.05; #:Yate's correction, df: degrees of freedom.

Table 3: Distribution of the palmar flexion creases among autistic patients and controls irrespective of sex and side differences.

DISCUSSION

Unusual dermatoglyphic traits played an essential role in understanding the neurodevelopmental imbalances or the alteration of brain growth, which were well documented worldwide [5,6]. Among the several dermatoglyphic traits, the association between Down's syndrome and Abnormal Palmar Flexion Creases (APFCs) as a means of single transverse creases or Simian line is probably the best-documented world widely [8,13,38-42]. Apart from Trisomy 21 or Down's syndrome, the association between the APFCs and other congenital aberrations like Klinefelter's syndrome, Turner syndrome [13], Fragile-X syndrome, West syndrome, Filippo syndrome, Cornelia de Lange syndrome, or genetic metabolic disorders [43] G6PD [44] has been well reported. However, APFCs have also been found with notable frequency in individuals having developmental defects caused by the alteration of intrauterine environmental exposure [45]. Nevertheless, the association between APFCs and environmental factors such as rubella [46] prenatal toxemia, hypertension [47] and intrauterine methadone exposure [48] has been well reported.

A significant increase in Sydney lines along with single transverse creases has been reported in Down's syndrome [49]. Previous studies have reported an association between APFCs and schizophrenia [50-52] and idiopathic intellectual disabilities [43]. Because skin and brain (neural tissue) develop from the same ectoderm, dermatoglyphic markers may provide specific information about early brain development [4] disorder in autistic patients.

Palmar dermatoglyphics on the volar side of the hand is formed at the end of the first. Within the second trimester of fetal development, so it seems that during that period, brain disorder development can occur [4]. It is a critical period in the etiology of autism and other neurodevelopment disorders. As a complex neurodevelopmental imbalance [53] with a robust genetic etiology [15,17,18,20,34,54].The current study included the single transverse creases and Sydney line as an APFCs trait measure among autistic patients from the Bengalee population [54-63].

CONCLUSION

Based on early detection, the threshold for autism can be managed from severe to moderate and from moderate to mild. Additionally, the therapeutic identification occurred two to three years after the newborn's birth. However, using the scientific methods of dermatoglyphics, the APFCs can be found shortly after an infant is born. The present study revealed the significant ($p<0.05$) occurrences of the single transverse creases and Sydney line on the left and right hands of autistic male and autistic female patients in comparison to the control males and females as well. However, the current study found that autistic patients had significantly more single transverse creases and Sydney lines than controls, regardless of sex or side differentiation. Therefore, the present study suggested the potential value of dermatoglyphic traits as one of the non-invasive techniques as well as a valuable aid for clinical diagnosis about the association of APFCs; single transverse creases, and Sydney line, as a risk factor and could be helpful for early prognosis of autism as well.

CONFLICT OF INTEREST

There are no conflicts of interest in the present study. All authors participated in this study with equal responsibility and interest. They all engaged in every aspect of this research work, including research ideas, literature review, study designing, data collection, data analysis, research paper writing, and revision. Moreover, this original research work has not been communicated elsewhere for publication.

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AUTHOR CONTRIBUTIONS

Conceptualization: BD, DC, ARB; Formal analysis: BD, PD; Investigation: BD; Supervision: ARB, DC; writing-original draft preparation: BD, PD; Writing-review and editing: BD, DC, ARB.

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