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Dermatoglyphic study of single bilateral interdigital flexion crease of the fifth finger in Bangladeshi Down syndrome people

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ABSTRACT

Different variants in the digital flexion creases are found in a number of syndromes, but rarely found in phenotypically normal individuals. This study was designed to observe the changes of dermatoglyphics in single interdigital flexion crease of the fifth finger present bilaterally in Bangladeshi Down syndrome people and to compare it with the normal subjects. This cross sectional observational analytical study was conducted in the department of anatomy, Chittagong medical college (CMC), Chattogram from January 2018 to January 2019. A total of 200 participants were included where 100 Down syndrome people were collected from different organization of Down syndrome society in Bangladesh. 100 MBBS and dental students of Chittagong medical college both male and female were selected as control. Dermatoglyphics print was taken by the ink and paper method described by Cummins and Midlo. Detailed dermatoglyphic analysis was done by using magnifying glass, calculator, and scale. After collection data was analyzed for statistical significance by chi-square test wherever applicable, by using a computer-based program SPSS 23 and MS Excel. P value was considered significant if it is < 0.05 at 95% level of confidence. The presence of a single flexion crease on the fifth digit replacing the normal two interpharyngeal creases were observed in right hand 12% and in the left hand 15% of the Down syndrome people and none of the control. It is revealed that there are significant differences on single bilateral interdigital flexion crease of the fifth finger between Down syndrome people and control.

Keywords Flexion crease, Fifth finger, Dermatoglyphics, Down syndrome

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1. Introduction

The palmar, wrist, and digital flexion creases represent skin flexion lines in the neighborhood of synovial joints, where the skin is attached to the underlying fascia [1]. Digital creases effortlessness movement of the digits without infuse by providing "folding points" in the skin analogous to the creases in a folded roadmap, and due to strong attachments to the underlying fascia, they also provide the steadiness to the skin required for strong grasping [2]. Two digital flexion creases are normally present on the thumb (metacarpophalangeal and interphalangeal creases) and three of them on the other fingers (metacarpophalangeal, and proximal and distal interphalangeal creases) [2]. A ring crease, usually present as a metacarpophalangeal crease on the third finger and fourth finger, is hardly ever found on the fifth finger [2].

Different variants in the digital flexion creases are featured in a number of syndromes. Excessive digital creases have been found in partial deletions of chromosome 1q, partial trisomy of 13q and 14q, cerebro-oculo-facio-skeletal (COFS) syndrome, as well as in sickle cell anemia [3-7]. A reduced number of digital flexion creases has been described in Down syndrome, Edwards syndrome, fetal alcohol syndrome and in some disorders involving digital joint flexion restrictions [8-10]. Both excessive and reduced numbers of digital flexion creases can be found in patients with Larsen syndrome [11].

The epidermal ridges begin to differentiate during 12^{th}-16^{th} week of fetal life and completed by 20^{th} week [12]. The skin of the palm of the hands and the plantar surface of feet is designed and corrugated with the epidermal ridges [13]. Dermatoglyphics deals with the study of the epidermal ridges and their configurations on the fingers, palms and soles [14]. Dermatoglyphic patterns remain unchanged throughout life [14]. The patterns of ridges that develop in the palm are determined genetically [15]. Any disturbance by genetic factors can produce unusual or abnormal dermatoglyphics during intrauterine life [16].

Worldwide the incidence of Down syndrome is one in 1000 live births [17]. Down syndrome can occur due to trisomy 21, robertsonian translocation or mosaicism. Trisomy 21 is a genetic disorder caused by the presence of all or part of a third copy of chromosome 21 [18]. The most common form of Down syndrome is known as trisomy 21, a condition where individuals have 47 chromosomes in each cell instead of 46 [18].

2. Materials and Methods

This research work was a cross sectional observational analytical study. The sample size was calculated by the following formula [19]:

$n= Z^2\ pq/e^2$

Z=Z value of standard normal distribution at a given level of significance or a given confidence level (at a 5% level of significance or 95% confidence level, Z = 1.96)

p= expected proportion of event; if not known, it is regarded as 0.5 q= 1-P= 1-0.5=0.5

e= acceptable error or precision in the estimate of p, usually set as 0.05

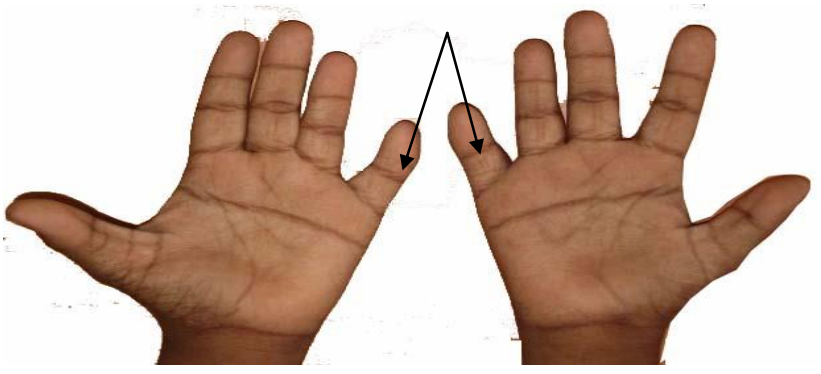
So calculated sample size was, $n= (1.96)^2 \text{ X } 0.5 \text{ X } 0.5 / (0.05)^2= 384.87$.

But due to time constraint a total of 200 participants were recruited, hundreds of them were from Down syndrome patient, and the rest hundred participants were students of both sexes enrolled in MBBS and dentistry at Chittagong medical college as the control group fulfilling the inclusion and exclusion criteria with informed consent. Ten percent of extra Down syndrome patients and students (total 110 +110=220) were taken to mitigate the dropping out of the subjects. Confirmed down syndrome patients was collected from different center in Bangladesh like down syndrome society of Bangladesh, prerona school, ashar alo school, proyas school and society for the welfare of the intellectually disabled, Bangladesh (SWID Bangladesh). Control were the year-I MBBS and dental students of both male and female of Chittagong medical college, fulfilling the inclusion and exclusion criteria were enrolled in the study with informed consent. Basic details such as age and sex of the subject were recorded from birth certificate, national identity cards or students ID card. Dermatoglyphics print was taken by the ink and paper method described by Cummins and Midlo [20].

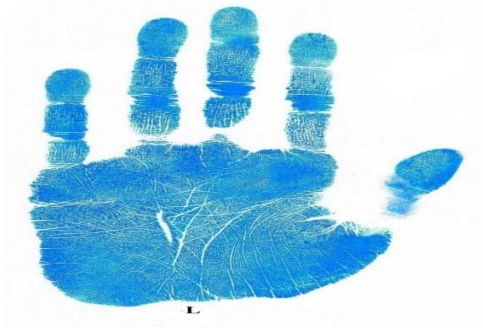
Sampling method: Convenient purposive sampling method was adopted to select all the research participants. Study period: From January 2018 to January 2019. Study place: The department of anatomy, Chittagong medical college, Chattogram, Bangladesh. Inclusion Criteria: Diagnosed Down syndrome patients of both male and female in any age group and 1^{st} year MBBS and dental students of Chittagong medical college were selected as research participants. All the palm print with good clear impressions was selected for further analysis. Exclusion Criteria: Down syndrome people and control group participants with any hand deformities due to injury, birth defect or permanent scar on any of the either hand, permanent scar on their fingers, worn, webbed or bandaged finger were excluded. Participants having neurological disorder e.g. seizure, multiple sclerosis, etc, signs of mental retardation like schizophrenia, cerebral palsy were excluded from the study. Skin diseases in fingers and palm of hand e.g. fungal disease, dermatitis, eczema, psoriasis, skin rash or hypersensitivity to ink were also excluded. Those who had congenital diseases or acquired deformities of the fingers of the hand other than down syndrome e.g. congenital heart disease, klinefelter syndrome,

turner syndrome, cleft lip, cleft palate, β Thalassemia, spina bifida (on the basis of history taking) and multifactorial diseases like-diabetes mellitus, hypertension, pulmonary tuberculosis were not recruited in this study.

Methods: All research participants washed their hands with liquid soap before inking to remove dirt. Then hands were wiped with paper towel. Two white papers were fixed on clip board to take fingerprint of right and left hand. Then clip board was placed on a wooden table. The required amount of ink was poured into a clean and dry flat bottom container. Hand roller was moved in the ink until the ink was spread thinly and homogenously in the roller. Both hands were painted with the help of the roller. The thin film of ink was applied on the palm and hand print was taken on the white paper fixed on clip board. First of all, the palmer aspect of the wrist was placed on the paper. Then slowly the palm was placed on the paper from proximal to distal end. The palm was then lifted from the paper in reverse order, from distal to proximal end. Then the individual was asked to clean both hands with turpin oil, liquid soap under running tap water and dried with paper towel. The painted papers were examined with magnifying glass (4x and 6x). Magnifying glass was used to zoom in the dermatoglyphics pattern of single bilateral interdigital flexion crease of the fifth finger. In this study dermatoglyphics pattern of interdigital flexion crease of the fifth finger in both hands were recorded in data sheet (Figure 1).



(a)



(b) **(c)**

Figure 1 (a) Single flexion crease in little finger in both hand of Down syndrome (arrow marked), **(b)** single flexion crease in left little finger in Down syndrome (arrow marked), **(c)** normal flexion creases in left little finger in control.

Statistical Analysis: After collection, data was analyzed for statistical significance by Chi-square test by using a computer-based program SPSS-23 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) and MS Excel. P value was considered significant if it was < 0.05 at 95% level of confidence.

Ethical Approval: The protocol of this study was approved by the members of the ethical review board (ERB) of Chittagong medical college, Chattogram and received a certificate of ethical clearance of ERB [Reference No.: CMC/PG/2018/479; dated 18/12/2018].

3. Results

3.1. Frequencies of single flexion crease in fifth digit

Percentage frequencies of single flexion crease in fifth digit of right hand in Down's syndrome and in controls are shown in Table 1. The presence of a single crease on the fifth digit of right hand replacing the normal two interpharengeal creases were observed in 12% of the Down syndrome people and none of the healthy controls ($p<0.001$).

Percentage frequencies of single flexion crease in fifth digit of left hand in Down's syndrome and in controls are shown in Table 2. The presence of a single crease on the fifth digit of left hand replacing the normal two interpharengeal creases were observed in 15% of the Down syndrome people and none of the healthy controls ($p<0.001$).

SFC in 5th digit	Down syndrome (n=100)	Control (n=100)	P value
Absent	88 (88%)	100(100%)	<0.001**
Present	12 (12%)	0(0%)	

Statistical analysis done by Chi square test, ** = statistically significant test (p<0.001).

Table 1 Percentage frequencies of single flexion crease in fifth digit of right hand in Down syndrome and in controls.

SFC in 5th digit	Down syndrome (n=100)	Control (n=100)	P value
Absent	85 (85%)	100 (100%)	<0.001**
Present	15 (15%)	0(0%)	

Statistical analysis done by Chi square test, ** = statistically significant test (p<0.001).

Table 2 Percentage frequencies of single flexion crease in fifth digit of left hand in Down's syndrome and in controls.

In Figure 2, overall in both palms, the single flexion crease in fifth digit was absent in control group. In contrast, single flexion crease in fifth digit was present 13.5% and absent 86.5% of Down syndrome people. These differences were highly significant (P<0.001).

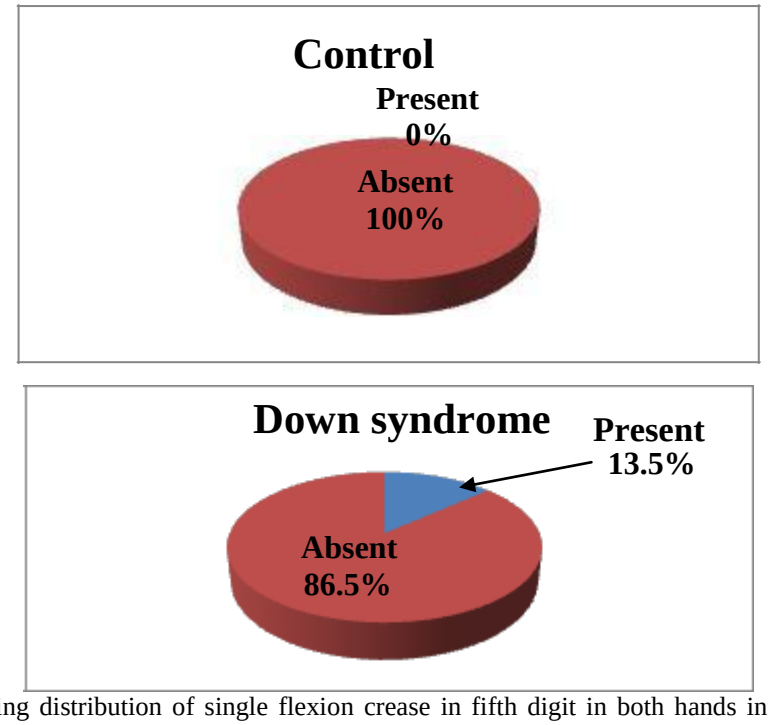


Figure 2 Pie chart showing distribution of single flexion crease in fifth digit in both hands in Down syndrome and control**.**

3.2. Discussion

The present study showed that, the presence of a single crease on the fifth digit of right hand replacing the normal two interpharengeal creases were observed in 12% of the Down syndrome people and none of the healthy controls and in the left hand 15% of the Down syndrome people and none of the healthy controls. Overall in both palms, the single flexion crease in fifth digit was absent in control group. In contrast, single flexion crease in fifth digit was present 13.5% and absent 86.5% of Down syndrome people. The presence of a single crease in the fifth finger was found in 28.0% of the patients, while no such a case was found in the control group in the study of shiono (1969) [21]. Bryant (1970) also observed that, no controls were seen with a single crease on the fifth finger while over 43% of the males and 28% of the females with mongolism had the trait [22]. A reduced number of digital flexion creases has been described in Down syndrome [8]. Bilateral presence of a single interdigital flexion crease on the fifth finger in the phenotypically and chromosomally normal individuals is extremely rare finding [23]. Penrose (1931) first described the presence of a single crease on digit 5 in 16 of 60 cases of Down's syndrome (26.7%). In 8 of these, the single crease was present on one

hand only [24]. Rodewald A (1977) found this peculiarity in a group of 200 patients with Down's syndrome (trisomy 21), in 21.5% symmetrically and in 45% asymmetrically [25]. The presence of the single crease on both hands (symmetrical) was found in 26.4% of the male patients and only in 13.4% of the female patients and these differences were highly significant (P<0.001) [25].

4. Conclusion

From the result of this cross sectional comparative study it was revealed that there were significant differences in single flexion crease on the fifth digit pattern between Down syndrome people and control. The presence of a single flexion crease on the fifth digit of right hand replacing the normal two interphalangeal creases were observed more in Down syndrome people and none of the controls. As the present study was conducted in a limited territory further large-scale study is recommended. This study was the first such observation and record in this area and can be used as the basic data which is useful for future research, biometric analysis and multi-disciplinary studies.

Conflict of Interest

The authors report no conflict of interest.

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