

Occurrence of Supernumerary Digital Flexion Creases: A Review

Pratishruti Palai¹, Dr. Priyanka Verma²

¹M.Sc. student Department of Forensic Science and Toxicology, UIAHS, Chandigarh University, Gharuan, Mohali, Punjab, India

²Associate Professor, Department of Forensic Science and Toxicology, UIAHS, Chandigarh University, Gharuan, Mohali, Punjab, India

Abstract:

Digital flexion creases are present at the interphalangeal joints of the fingers. In some cases, there are extra digital flexion creases found in an individual, which are a rare occurrence. These extra creases are present in individuals very rarely and provide more individualistic and unique identification hence can be utilized in concealing the identity of the criminals in forensic investigations. With more studies done on digital flexion creases, they can be utilized in identification in criminal investigations and mass disaster cases. The digital flexion creases can also be studied in relation to different syndromes and abnormalities.

Keywords: Digital Flexion Crease, Supernumerary, Investigation, Syndrome, Occurrence

INTRODUCTION

The fingers of both hands have three phalanges which are known as the proximal phalanx, middle phalanx, and distal phalanx, excluding the thumb, which has only two phalanges namely the proximal phalanx and distal phalanx [1]. These phalanges articulate with each other to form interphalangeal joints. Digital flexion creases are thus formed transversely on these interphalangeal joints. Digital flexion creases can be defined as the grooves or depressions present on the palmar surface of fingers. The site of these creases “provide firmer attachment to the skin and its underlying structures”. It is also a region where delayed growth takes place [2]. These creases provide steadiness for holding an object and ease in the movement of fingers. As these are a very unique feature, they along with palmar, thenar, and wrist creases, are considered as external anatomical landmarks [3]. Since there are three interphalangeal joints present on each finger, except for the thumb which has two, generally three digital flexion creases are found on each finger. In rare cases, the count of these flexion creases is more or less than three. Dejong and Platou (1967) were the first to define additional flexion creases. The extra digital flexion creases were defined as “creases that are present in addition with the usual inter-phalangeal crease which disrupts the local ridge configuration” [4]. Flexion creases are named so because these creases are employed during the flexion movement of the fingers.

The origin and development of the flexion creases that are present on the fingers have been subjected to some controversy. One of the hypotheses claimed that the flexion creases are developed because of the flexion movement of the foetal hand. It was also reported that there was abnormal crease pattern formation in malformed hands [5]. Kimura and Kitagawa also demonstrated that since the digital flexion creases appeared from 7th to 9th weeks of gestation and the foetal movement starts from 11.5 weeks of gestation, movement of the hand of the

foetus is not the primary cause for the formation of digital flexion creases [6]. Thus this claim was refuted. Cathy A. Stevens, et al. determined that the digital and palmar creases developed between the 8th and 13th foetal week. The digital creases are also well defined by the 10th week of the gestational period. If any malformation occurs before the creases become fully developed then the pattern of the hand can get altered. But the movement of the foetal hand is also required in the formation of crease patterns [7].



Figure 1. Supernumerary digital flexion creases of different patterns on the index, middle and annularis fingers of the right hand. Uko V. A. et. al. (2012), retrieved from IJB AIR. [16]

Another hypothesis formulated that the creases are developed due to predetermined genetic conditions, independent of the foetal hand movement. Although the movement of the hand is required for the normal crease formation, the creases have already been formed before the movement of foetal hand starts at 11.5 weeks [6]. The specific contribution of hereditary elements still remains uncertain. Therefore both genetic factors and movement of the hand of the foetus to a certain extent, are required for the development of the digital and wrist crease patterns.



Figure 2. Supernumerary digital flexion creases found on both the little fingers bilaterally. Dey S, Kapoor AK (2017), retrieved from ResearchGate. [14]

Abnormal Digital Flexion Creases

According to previous research conducted on digital flexion creases, it was studied that the different patterns were associated with various genetic factors. Excess or reduced number of digital flexion crease can suggest genetic abnormalities [7]. A reduced number of interphalangeal creases are seen in various conditions such as Down's syndrome, 18- trisomy, de Lange syndrome, partial trisomy. It has been reported that in cases of Down's syndrome, 18-trisomy, de Lange syndrome, and oral-facial-digital syndrome a single digital flexion crease is found on the little or fifth finger of either hand [7, 8, and 9]. Missing or reduced number of flexion creases are also seen in people having mental deficiency. Supernumerary digital flexion creases, fingers having more than the normal number of digital flexion creases, are reported in cases of Allagile syndrome, foetal alcohol syndrome, partial deletions of chromosomes, sickle cell anaemia, and Cerebro-oculo-facial-skeletal syndrome [7]. Both supernumerary and missing digital flexion creases are recorded in individuals having Larsen syndrome [10]. Studies have reported that 75% of the people having extra digital flexion crease had alterations in Alagille syndrome involving the disease gene, JAG1 and 83% of individuals without extra digital flexion creases showed positive mutation [11]. In patients of sickle-cell anaemia, 24-90% individuals possessed extra digital flexion crease on the joint of the distal inter-phalanges.

Apart from genetic abnormalities and disorders supernumerary digital flexion creases can also be found in phenotypically normal and healthy male and females, who have normal bone structures [10, 12]. The extra digital flexion creases can be present on any of the fingers of either hand. These creases can be unilateral i.e. occurring on a single digit of one hand or bilateral, occurring on two digits of both the hands [10]. Komatz et al. reported that 7-11% of a specific population had extra digital flexion crease on their distal interphalangeal joint and the 5th finger having extra digital flexion crease was very rare, with only in 1% of the population having it [13].

Forensic Significance

The supernumerary digital flexion creases are present in a very less number of individuals thus they are rare. Therefore they can be used for individualisation and identification of individuals and have a huge forensic impact. They can be used when dismembered remains are found from scenes of crime and mass disasters. With the advancement of technology, it can also be used to identify a person from CCTV footage where only the hand or a part of it of the person is visible. It can help in narrowing down the possible suspects [14]. Most importantly these dermatoglyphic creases are related to genetic conditions. They reveal chromosomal abnormalities and other health conditions. It can help in case a person has an undiagnosed health problem.

DISCUSSION

Supernumerary digital flexion creases are mostly linked with genetic abnormalities and disorders. But they have also been reported in a small number of normal healthy individuals. The studies conducted by various researchers on the supernumerary digital flexion creases have shown that although they are a rare occurrence, extra digital flexion creases can appear on any of the digits of an individual either on the left or right palm of an individual. Extra

digital flexion crease was found to be most rarely found in the little finger [15]. Dey and Kapoor (2017) reported that 1 in 13 individuals showed the presence of supernumerary digital flexion crease. Males also had more prevalence of supernumerary digital flexion creases than females (ratio 16:7). According to their study, the ring or annularis finger had the most number of supernumerary digital flexion creases compared to other fingers [14]. Another study conducted on the student population in Edo (Nigeria), showed similar results. The extra digital flexion creases occurred more on the left palm and also on the ring finger of individuals. Also, males had more extra digital flexion creases present than females [16]. However, studies done by Dejong and Platou (1967), Zizmor (1973), and Komatz et al. (1978) showed that the presence of supernumerary digital flexion crease was restricted to a particular finger [17]. Kosztolanyi and Meyes (2003) in their studies found a multi-digit prevalence of the extra digital flexion creases [18]. These different studies were done on different populations. Many studies in the field of dermatoglyphics have aided in use of different methods of development of latent prints using different powders hence solving countless civil and criminal cases from all over the globe [19]. It may be deduced from these works that the prevalence of the supernumerary digital flexion creases varies in diverse populations. There is also a need for more examination and exploration to fill the gaps in the knowledge of our understanding of crease patterns [20].

CONCLUSION

It can be concluded that the supernumerary digital flexion creases in humans are very few and rare and are highly individualistic far between in populations, thus they are an important dermatoglyphic landmark with significant forensic importance in concealing the identity of criminals. Most importantly these dermatoglyphic creases are related to genetic conditions. They can indicate chromosomal abnormalities and other health conditions. With further studies on the supernumerary digital flexion creases in various ethnic populations, they can have global significance in the medico-legal, forensic and humanitarian fields.

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