

## The Importance of Four-Finger Furrow in the Diagnosis of Pediatric Chromosomal Anomalies

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### Editor Note

Since Langdon-Down in 1909 paid special attention to the special formation among the flexion furrows of the human hand, generally known as Affenfurche or Vierfingerfurche, in connection with the clinical picture of mongoloid idiocy, investigators have dealt with this subject again and again and from the most different points of view. Anthropologists were interested in the occurrence of this furrow form in humans and apes from a phylogenetic point of view [1-4].

Physicians were interested in the relationship of the morphological peculiarity mentioned to certain clinical pictures; especially in recent times the problem of the four-finger furrow in connection with mongoloid idiocy has been turned to again. Developmental-physiological studies have been carried out, which deal with four finger furrows in general and in particular within the framework of hand furrow development, and finally the hereditary biologist was and is interested in clarifying the question of heredity or the course of inheritance of this characteristic for scientific and practical reasons [5-8]. According to the observations made so far, there is no longer any doubt that there is a hereditary form of

VFF; on the other hand, it happens again and again, that it occurs sporadically in families and that identical twins behave discordantly. The four-finger furrow is a flexion fold palmar (i.e., on the palm of the hand) that runs perpendicular to the long axes of the fingers and extends from the little finger to the index finger. It runs parallel to the metacarpophalangeal joints of the fingers. Furrows of the palms (palm lines) occur in all people. Usually these furrows are rounded, so they do not run straight, but in individually curved arcs. A VFF is the fusion of the three-finger furrow (DFF) and the five-finger furrow (FFF) into one, which runs across the palm and in most cases merges with the thumb furrow (DF) at the radial edge of the hand. The terms monkey furrow and blocking line

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were formerly used as synonyms for four-finger furrow. The term four-finger furrow has since become accepted because it has a neutral connotation. The term monkey furrow stemmed from the fact that higher order primates and many animals with prehensile hands possess such a furrow. The term blocking line was chosen to illustrate the division of the palm by the furrow. A VFF is now composed of the following furrow parts: the index finger section of the FFF, the palm section of the DFF and a characteristic intermediate segment that connects the two parts mentioned. At the same time, the formation of the interfinger and index finger sections of the DFF and the palm section of the FFF is underdricated, resulting in the appearance of a transverse furrow running from the ulnar to the radial edge of the hand: the familiar image of the VFF. From these brief hints it can already be seen that - due to the complicated course of development and the interlocking of the various components - there must be many possibilities in the phanic picture which lie between the two extremes, namely the normal furrow pattern on the one hand and the classical VFF on the other. The reduction of certain furrow sections, which is necessary for a clear VFF, need not always be complete, but can appear in the most varied degrees of expression. It may be completely absent, but DFF and FFF may be clearly connected by the intermediate segment. Such furrow patterns, called brique formations or transitional forms, have been repeatedly referred to by investigators in connection with VFF. They occur much more frequently than the fully formed VFF. Researchers distinguish three degrees of VFF: a weak form "3", an intermediate form

"2" and the classical VFF form "1". Among the degree of expression "3", which is much more frequent than the degrees "1" and "2", there seem to be forms that have arisen accidentally and have no genetic connection with the classical VFF. This is especially true when the weak form occurs on only one hand. In contrast, bilateral adhesions suggest a connection with VFF. The relationships of the forms "1" and "2" with each other are apparently closer than with the weak form "3". The classical VFF seems to occur more frequently on the left hand and in the male sex than on the right hand and in the female sex. In this behavior there is a parallel with the thenar patterning. The results obtained for the average population are also valid for the twins. Moreover, it could be proved by computational methods that the preferred concordant behavior of the EZ pairs and the preferred discordant behavior of the ZZ pairs are the expression of hereditary bases of the trait VFF and its transitional forms. The main difference between EZ and ZZ is that discordance in EZ occurs mainly when one partner is unilaterally afflicted. Furthermore, the more pronounced the discordant pairs are, the less frequent they become, while the more pronounced the discordance becomes in the ZZ pairs. Absolute concordance, i.e. both partners have the same degree of homologous hands, is also more frequent in EZ pairs than in ZZ pairs. On average, 75% of all people with a form of trisomy (triplication of a chromosome or chromosome segments) such as is the cause of e.g. Down syndrome (trisomy 21), Patau syndrome (trisomy 13), Edwards syndrome (trisomy 18), trisomy 16 or trisomy 8 have a four-finger furrow in one palm or on both palms. Also, in people with

Zellwegersyndrome, Aarskog syndrome, C trigonocephaly syndrome, Noonan

syndrome, Smith-Magenis syndrome, Wolf-Hirschhorn syndrome, Smith-Lemli-Opitz syndrome, De-Grouchy syndrome, Schinzel-Giedion syndrome and Cri-du-chat syndrome (catcry syndrome/chromosome 5p syndrome) or Rüdiger syndrome, this form of palm marking occurs more frequently than in people without chromosomal peculiarity

[7-9]. In contrast, four-finger furrows occur in the general population in only one to two out of 100 people. Predominantly, this form of palm marking is found in boys or men. Four-finger furrows have no medical or physical relevance in humans [10-12]. They do not restrict the mobility of the hand in any way and do not influence its function. The characteristic of a four-finger furrow without further symptoms is in general no indication of a chromosomal peculiarity or a cognitive handicap.

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