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INTERDIGIT DEPTH, FINGER LENGTH AND THEIR INTERRELATIONSHIP IN ADULTS

The interdigital spaces separating individual fingers, may sometimes show deviations from the norm consisting mostly of a shortening. It has been suggested that a shorter interdigit (due to a higher interdigital skin fold) represents a microform of syndactylia, and that its occurrence in a family at risk is of great importance for the determination of the prognosis within the scope of genetic counselling (Šmahel 1974). Syndactylia is either total or partial with an involvement of soft tissues and sometimes equally of bone structures. Measurements provide the basis for an exact assessment of the degree of syndactylia, as well as of the results of surgical repair.

It was assumed that changes in the interdigit depth might accompany some inborn malformations. Hajniš and Farkaš (1965) therefore, suggested that measurements should be carried out regularly in various malformations but until the present time this procedure has not been adopted and thus exact evidence is lacking. Thus it is obvious that further knowledge, data and norms for plastic surgery, as well as for the study of inborn malformations, genetic counselling and other disciplines are needed.

The main purpose of this study was to provide a contribution to the following investigated problems: 1. To establish the norm and the variability range of the interdigit depth in adult males and females which would supplement the data reported so far in children and adolescents. 2. To propose a uniform method of measurements, and 3. to devise technique for an objective, i.e. metrical determination of the boundary between normal and reduced interdigit depth and to verify whether this method is satisfactory. The last mentioned point was investigated in an effort to objectify the diagnosis of various anomalous deviations and variations and thus it is aimed at the devising of a uniform technique which would provide the possibility to compare the results of prospective studies (as it was devised for changes and anomalies of the interocular distance; Šmahel, Figalová 1975).

The literature contained up to the present time only a few reports dealing with metrical studies of interdigits. In the Czech literature they included the diploma thesis of Křečková (1966), Jägerová (1966) and Šimůnková (1966) who studied the growth of the hand, fingers and interdigits from birth up to eighteen years of age. Their results were summed up and published by Hajniš (1968, 1973).

MATERIAL AND METHODS

Our report is based on anthropometric examinations of 59 normal males and 67 normal females from Bohemia which were carried out in the past two years. The age of probands in our series ranged from twenty to forty five years and thus corresponded to the present generation of parents attending our genetic counselling, as well as to those included in our investigatory series. The mean age of males was 36 years and in females it was 32.3 years. The mean stature of males was 173 cm, and thus was in agreement with the data obtained at the 3rd Czechoslovak Spartakiade in the corresponding age group (Fetter, Suchý 1966). The mean stature of females was 160.9 cm, which is 1.7 cm below the reported value but the difference is not significant. The basic parameters ascertained in our series, thus, are within the range reported in our population and can serve for the calculation of the required norms.

From the characteristics determined in this study it is presented the following: the depth of individual interdigits, and the length of all fingers. The

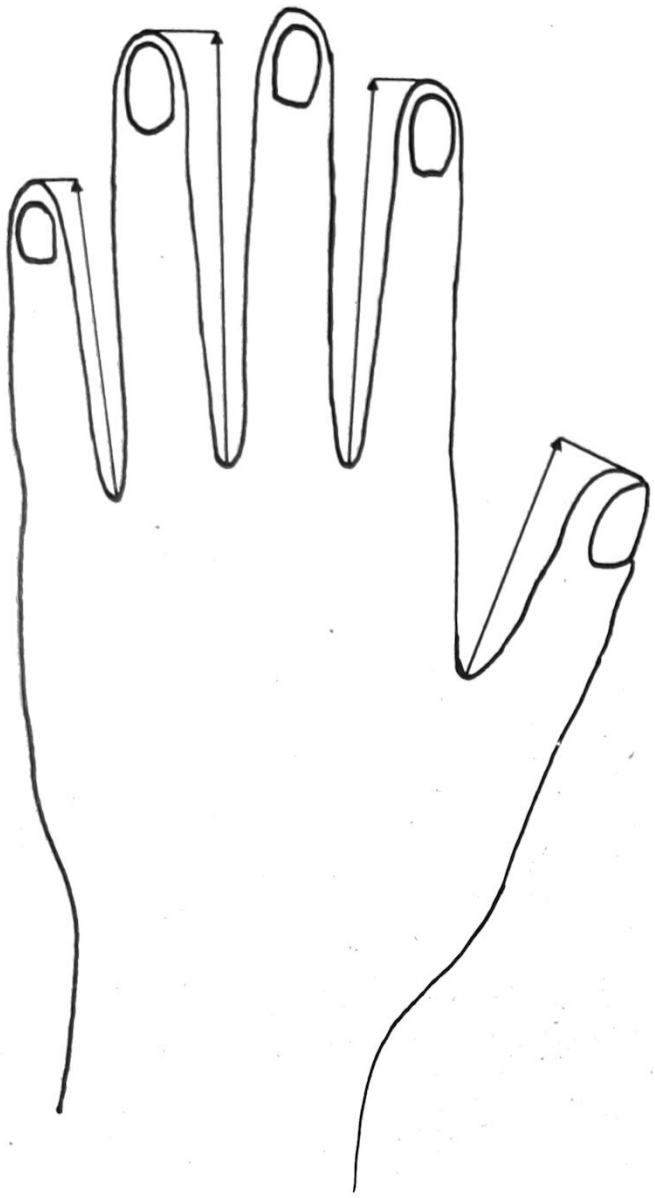

FIG. 1. *Method of measurements of interdigit depth in the hand.*

fingers were measured with a sliding caliper as the distance between phalangion point and the corresponding dactylion point by the standard method (Martin, Saller, 1957). The interdigit depth was measured with the same instrument and on fingers in slight abduction as the distance between the interdigital skin fold and the tip of the first and second finger in the first and second interdigit and to the tip of the fourth and fifth finger in the third and fourth interdigit *(Fig. 1)*. The ascertained data are presented in tables 1 and 2, inclusive of results of the t-test determining the difference from values in the highest age group of the series reported by Hajniš (1968, 1973); the signs + or − show whether the value obtained in our series is higher or lower ($\bar{X}$ = mean, s = standard deviation, $s_{\bar{x}}$ = mean error, V = variation coefficient). An index expressing the interdigit depth in terms of per cent of the length of the finger on which it was measured is presented in *Table 3*. An attempt was made to use the values of the index for an objective determination of the boundary between a normal and reduced interdigit, since this is the only way providing the possibility to obtain a standard uniform norm for all age groups.

RESULTS

The depth of individual interdigits in adult males and females are presented in *table 1*. The values ascertained in males were regularly by 4—6 mm higher than the corresponding values in females. The depth of the first interdigit approximated to that of the fourth and the depth of the second to that of the third. In females there was a similar agreement between the first and fourth interdigit, the second was by 1—2 mm longer than the third. This difference was due to the relative length of fingers, which is in females most frequently of the digital type 324, i.e. the second finger is relatively longer than the third finger, while in males there is a marked predominance of the opposite type 342 (Škvařilová, 1975). The variation coefficients show a moderate degree of variability; the comparison with values reported by Hajniš (1973) in boys and girls aged 18 years yielded a nonsignificant difference in the first and second interdigit (the third and fourth interdigits were measured in a different way and therefore a comparison with our values is not possible). The difference between both hands are negligible and irregular.

Table 2 presents the norm for the length of all fingers. The difference of finger length according to sex range from 6.5—9.5 mm. The mean values, but for one exception, are higher on the right side, however, always only by less than 0.7 mm. Since the metacarpophalangeal joint IV. and V. are deflected in proximal direction from the line of MP joints the fourth finger, in contrast to its relative length, is always longer than the second finger. The difference averages to 4—5 mm (min. 0—max. 10 mm, but for one exception in both sexes, i.e. it is less than 2 per cent). The variation coefficients range from low to moderately high values, the comparison with the data reported by Hajniš (1968) failed to disclose in any case a significant difference.

When the depth of each interdigit is expressed in percentage of finger length to the nail tip of which the interdigit was measured *(Tab. 3)* then the depth of the third and fourth interdigit attains in both sexes approximately 71—72 per cent, the depth of the second interdigit 75—76 per cent in males and 77—78 per cent in females, and the depth of the first interdigit 87—88 per cent in males and 90—91 per cent in females. The corresponding values calculated on the basis of mean value in the highest age group (18 years) of the series reported by Hajniš (1968, 1973), are in boys 89—90 per cent for the first interdigit and 75—76 per cent for the second interdigit, and in girls 87—89, and 78—79 resp. The results are in good agreement. The variability is low, with the exception of the index value of the first interdigit where the variation coefficients are moderately high.

TABLE 1

Depth of interdigits in adults (in mm)

interdigit		males (n = 59)					females (n = 67)				
		$\bar{X}$	s	$s_{\bar{x}}$	V	t-test	$\bar{X}$	s	$s_{\bar{x}}$	V	t-test
I	dx	58.88	4.24	0.55	7.20	+0.81	54.15	4.12	0.50	7.61	+0.48
	sin	58.27	4.12	0.54	7.07	—0.52	54.21	3.74	0.46	6.90	+1.64
II	dx	73.46	4.47	0.58	6.08	—0.28	69.28	4.80	0.59	6.93	—1.19
	sin	74.42	4.69	0.61	6.30	—0.35	70.08	4.36	0.54	6.22	—0.22
III	dx	74.19	4.58	0.60	6.17	not comparable	68.34	4.36	0.53	6.38	not comparable
	sin	73.78	4.58	0.60	6.21		67.63	4.36	0.53	6.45	
IV	dx	59.31	4.80	0.63	8.09		53.72	4.24	0.53	7.89	
	sin	58.72	4.58	0.60	7.80		53.12	4.47	0.55	8.41	

TABLE 2

Finger length in adults (in mm)

finger		males (n = 59)					females (n = 67)				
		$\bar{X}$	s	$s_{\bar{x}}$	V	t-test	$\bar{X}$	s	$s_{\bar{x}}$	V	t-test
I	dx	66.68	3.74	0.49	5.61	+1.86	60.18	3.16	0.39	5.25	—0.03
	sin	66.53	3.46	0.45	5.20	+1.12	59.78	3.32	0.41	5.55	—0.64
II	dx	98.34	4.58	0.60	4.66	+0.03	89.90	4.36	0.53	4.85	—0.18
	sin	97.85	4.47	0.58	4.57	—0.39	89.33	4.24	0.52	4.75	+0.24
III	dx	109.03	4.90	0.64	4.49	+0.45	99.71	4.69	0.57	4.70	—1.31
	sin	108.80	5.00	0.65	4.60	—0.18	99.37	4.80	0.58	4.83	—1.41
IV	dx	103.15	4.90	0.64	4.75	+0.29	94.26	5.10	0.62	5.41	+0.70
	sin	103.05	4.69	0.61	4.55	+0.30	93.57	5.20	0.63	5.56	—0.39
V	dx	81.93	4.58	0.60	5.59	+0.97	74.77	4.24	0.52	5.67	+1.23
	sin	82.00	4.24	0.55	5.17	+0.79	74.68	4.69	0.57	6.28	+1.20

DISCUSSION

The comparison of our data with the results of other Czech authors (Jägerová 1966, Křečková 1966, Šimůnková 1966, Hajniš 1968, 1973) concerning finger length and the depth of the first and second interdigit in probands of both sexes aged 18 years disclose no significant difference. It showed that in smaller length dimensions it is possible to use, for a rough estimation and assessment of somatic characteristics of an adult population, the data obtained in age groups where the main growth is already terminated, since secular trend is of no substantial importance (because of the subsequent development of the body it is not possible to use this procedure in width, depth and circumference dimensions). However the variability range is distinct and therefore a series of adult probands with an adequate age distribution is mandatory for definite comparison and testing. Thus the investigations of adult population groups should not be omitted.

The indexes of interdigit depth and finger length *(Table 3)* were used in an attempt to determine on the basis of standard deviations, the boundary between normal and reduced interdigits. For the verification of these boundaries we have calculated the above mentioned indexes in individuals selected from our clinical material and in whom a shortening of interdigits was found on visual inspection. In some cases the values were only by one standard deviation lower and in one case they corresponded to the norm. In spite of the low variation coefficients these indexes show an overlapping of distribution and thus their values could not be used for the metrical diagnosis of an interdigit shortening. It is obvious that the determination of normal or anomalous conditions cannot be based on the normal distribution of characteristics alone, and that the verification of the results obtained should be based on the observations of clinical series. The indexes calculated on the basis of mean values reported by Hajniš (1968, 1973) for all age groups from 0—18 years equally vary within a broad range (77—96 per cent in the first interdigit and 70—80 per cent in the second interdigit in both sexes), even though the author concluded that the growth of the two compared characteristics was similar. In order to attain the purpose of our study it will be necessary to use the same metrical techni-

TABLE 3

Index of interdigit depth and finger length in adults $\left(\frac{\text{interdigit depth} \times 100}{\text{finger length}}\right)$

index		males (n = 59)				females (n = 67)			
		$\bar{x}$	s	$s_{\bar{x}}$	V	$\bar{x}$	s	$s_{\bar{x}}$	V
I	dx	88.17	4.90	0.64	5.56	90.08	5.20	0.64	5.77
	sin	87.45	4.69	0.62	5.36	90.68	4.80	0.59	5.29
II	dx	74.54	3.32	0.44	4.45	76.88	3.46	0.43	4.50
	sin	75.98	3.32	0.44	4.37	78.28	3.00	0.37	3.83
III	dx	71.67	3.00	0.39	4.19	72.58	3.00	0.37	4.13
	sin	71.36	3.00	0.39	4.20	72.38	2.83	0.35	3.91
IV	dx	72.00	3.46	0.45	4.81	71.66	3.00	0.38	4.19
	sin	71.34	3.16	0.41	4.43	71.16	3.46	0.44	4.86

que applied only for the measurement of the basal phalanx. This is the subject of a further study.

The method of measurement used for the determination of the interdigit depth are not uniform. Hajniš (1973) measured the depth of the 3rd interdigit to the tip of the third finger and the depth of the 4th interdigit to the tip of the fourth finger. In our opinion, however, it is necessary to measure the third interdigit to the tip of the fourth finger and the 4th interdigit to the tip of the fifth finger *(Fig. 1)*. The former technique does not determine the actual depth of the interdigit and thus even when two fingers are completely grown together always yields a certain interdigit depth given by the difference between the dactylion points (fingertips) of the 3rd and 4th finger, or of the 4th and 5th finger resp. The data obtained in this way are neither characteristic for the degree of webbing, nor comparable with the data obtained in the 1st and 2nd interdigit. Only the use of an uniform and exact method is capable of yielding results of practical value.

As far as the question of an association of deviations in interdigit depth with various inborn malformations is concerned, we have so far failed to disclose this association which was missing even in patients with syndactylia during the measurement of intact interdigits (Šmahel, in press). Therefore, we do not anticipate their occurrence in other inborn malformations and we are of the opinion that the shortening of an interdigit represents a microform of syndactylia or a syndrome with syndactylia as an inherent component, and that it does not represent a sign associated with other malformations.

SUMMARY

The norms and the variability range of the depth of individual interdigits and the finger lengths in adult Czech males and females are presented. The interdigit depth is regularly by 4—6 mm higher in males than in females and the depth of the first interdigit corresponds approximately to that of the fourth and the depth of the second interdigit to that of the third. In females the measurements disclosed a slighter difference between the 2nd and 3rd interdigit (the latter was 1—2 mm longer) which was due to a markedly higher frequency of the digital type 324 compared to men. The differences in finger length according to sex were 6.5—9.5 mm. The fourth finger was actually always longer than the second one (on the average by 4—5 mm), even though the digital pattern might show a prominence of the second finger over the fourth (type 324).

Expressed in terms of per cent of the length of the pertinent finger the depth of the 3rd and 4th interdigit ranged in both sexes from 71 to 72 per cent, the depth of the 2nd interdigit was 75—76 per cent in males and 77—78 per cent in females; the depth of the 1st interdigit was 87—88 per cent in males and 90—91 per cent in females *(Tab. 3)*. However evidence was provided that the values of these indexes cannot serve as the basis for an objective, i.e. metrical assessment of an interdigit shortening because of the overlap with the normal variability range. We intend to test for this purpose an identical metrical method applied only for the measurement of the basal phalanx.

The method used for the measurement of interdigits should be exact and uniform. The depth of the 3rd interdigit should be measured from the interdigital skin fold to the tip of the fourth finger and the depth of the 4th interdigit to the tip of the fifth finger and not to the tip of the third finger (3rd interdigit) or to the tip of the fourth finger (4th interdigit). The last mentioned method does not measure the actual depth of the interdigit and thus, even in the case that two fingers are completely grown together, this procedure always yields a certain depth given by the distance between the dactylion point (fingertip) III. and IV., or IV. and V. resp. These data cannot characterize the degree of syndactylia and are not comparable with those obtained for the 1st and 2nd interdigit.

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