CORRELATION BETWEEN PROXIMO-DISTAL POSITIONING OF AXIAL TRIRADII (t, t′, t″) AND THE NINE-GRADE SCALE OF ANGLE atd VALUES IN PALMAR DERMATOGLYPHICS: A METHODOLOGICAL STUDY

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INTRODUCTION

Location of anatomical positioning of axial triradius on the palmar prints has been a subject of several research papers beginning with W i l d e r (1901— 1902: 429) who referred to it as the "carpal triradii (tr. c.)". One of the first schemes to formulate methods of analysis was that of Wilder (1904: 244—293) whose methods were revised later (C u m m i n s et al. 1929: 415—473). The latter "constitute a revision of Wilder's original procedures (W i l d e r, 1916, 1922; W i l d e r and W e n t w o r t h, 1918) . . ." (C u m m i n s 1930: 125). These were re-presented in a later text (C u m m i n s and M i d l o 1943 & 1961: 99). That the problem is a g e n u i n e o n e cannot be too strongly emphasized because of, firstly, the author's own concern (S h a r m a 1961 a: E 111; Sharma 1962; Sharma 1963 a: 1529—1531; S h a r m a 1964 d: 167—170) while analysing the bilateral palmar prints of the Burmans collected from Burma (1953—1955) and. secondly, in the light of that classic "study of error in interpretation and formulation of palmar dermatoglyphics" (C u m m i n s et al. 1928: 501—521). The six workers differed widely in their assessments: C u m m i n s et al. (1928: 512) rightly attributed these differences in incidences to "latitude allowed in the present standards" and referred to these errors as "errors of interpretation and formulation". Similarly, F l e i s c h h a c k e r [1951: (b) in Summary] reflected upon "the deficiency of method and difficulties of determination" as a possible source of concealing actual differences between different populations. Most certainly the problem of "p e r s o n a l l y v a r y i n g s t a n d a r d s" followed by different workers is a genuine one but that does not in the slightest imply that the maximal angle atd (P e n r o s e 1949: 412—416; P e n r o s e 1954: 10—38) measurement is an effective replacement (!), especially in the light of the present writer's proposed metric modification (S h a r m a 1961a: E 111; S h a r m a 1963 a: 1529—1531) that has been followed by him and his students since 1955; this metric method ultimately leads to the t-Index (S h a r m a 1964a: 167—170). In a recent study, G e i p e l (1961: 338) has concluded: "...Now that L e j e u n e, G a u t h i e r and T u r p i n have confirmed that 'mongols are trisomic for one of the smallest acrocentric autosoms' the investigation of angle atd proves unnecessary. P e n r o s e certainly is of the same opinion." I have independently come to a similar conclusion (S h a r m a 1962) — though differently — propounding that: (I) magnitude of angle atd is dependent on relative positioning of a and d to t, (vide S h a r m a 1963 c, 1963 d, 1964 c) and (II) the replacement is not at all required because the two metric techniques convey two separate metric concepts (S h a r m a 1961 b: E 112; S h a r m a 1963 b: 1537—1541; S h a r m a 1964 b: 24—31).

PROBLEM

To assess the extent of correlation between the positioning of axial triradius (t, t′, t″) and angle atd values nine-grade scale recently suggested (M a v a l w a l a 1963: 77—80). Do the nine classificatory numbers of angle atd values (1963) exactly indicate the nature of positioning of axial triradius (t, t′, t″) on palmar surfaces? Can these numerals effectively and meaningfully constitute a replacement of the existing methods of distinguishing the different levels of axial triradii (t, t′, t″)?

MATERIAL

The bilateral inked impressions of 400 Burman males collected without any bias (S h a r m a 1962: 5—12; S h a r m a 1963 e: 231—239).

METHODS

The methodological approach in the present paper is based upon the writer's firm conviction that all progress in research methods is possible only if the current conceptions and existing analytical practices are scrutinized, challenged and then s u p p l e m e n t e d by the more meaningful, pragmatic and, if possible, such quantitative measures as minimize the error due to "personally varying standards" (having roots in the qualitative approaches), and not just total replacements of the existing methods, unless, of course, these are totally absurd or bereft of any scientific method. Time-tested approaches may be extended by fresh metric or other accurate orientations, but should not be discarded without any proper testing.

Angular values at t, t′, t″ of atd have been kept apart from each other as is also explained in another paper (S h a r m a 1964 b: 24—31). "The most medial d triradius and the most lateral a triradius"

(P e n r o s e 1954: 10—11) were selected so as to procure the maximal angular values of atd, at′d, at″d at each of the three segmental positions. In calculating the mid-points 8, 25, 42 of the three segmental positions of axial triradii t, t′, t″ vide S h a r m a's metric orientation (1961 a: E 111; S h a r m a 1963 a: 1529—1531), use has been made of t - I n d e x distribution as shown in Table I. It

TABLE 1

3 Segments	Limits of t-Index	Mid-point level
Proximal segment (t)	16.65	8
Intermediate segment (t′)	16.66 to 33.32	25
Distal segment (t″)	33.33 to 50.00 and above	42

is necessary to point out this little detail regarding the first variate because the mid-points of 3 positions of axial triradii have been taken to the nearest whole number of the limits shown. For example, the exact mid-point of 16.65 in case of segment will be 8.3, 24.99 in case of t′-segment, 41.66 in case of t″-segment but, in actual practice, these have been taken as 8, 25 and 42 respectively for t-, t′- and t″-segments. Similarly, the mid-points taken for the other variate ("nine grade angular scale") are 27°, 32°, 37°, 42°, 47°, 52°, 57°, 62° and 67° for the angle atd numerals 1—9 respectively. Value of r has been calculated between these listed variates.

Distributional peculiarities of the nine numerical groupings vis-à-vis proximo-distal anatomical positioning of axial triradius have been dealt with some degree of emphasis in the present study (see Table 2). To recapitulate, there are 371/853 (43.5 %)

TABLE 2

Angle Classes	No. (Mavalwala)	t — position: t	t′	t″	Total
Less than 30°	1	8	3	—	11
30.1°—35°	2	64	37	—	101
35.1°—40°	3	198	141	1	340
40.1°—45°	4	98	140	6	244
45.1°—50°	5	3	50	35	88
50.1°—55°	6	—	7	31	38
55.1°—60°	7	—	2	15	17
60.1°—65°	8	—	1	5	6
65.1°	9	—	—	8	8
Angle Absent or N	(10)	(12)	—	—	(12)
Total		371 (+12N)	381	101	853 (+12N)
Angle range		29°–47° (+12N)	29°–61°	37°–72°	29‴–72° (+12N)
r = + 0.384 ± 0.029					

angle atd values at t, 381/853 (44.7 %) at′d values and 101/853 (11.8 %) at″d values, 12 cases being "indeterminate" (or N) owing to conditions 0, p or actually incomplete printing (S h a r m a 1964 b: 24—31); the total number of angles measured thus comes to 853 on which is based the present study.

DISCUSSION

It is gathered that angular values ranging from 29° — 47° are associated at t position with Mavalwala's numbers 1 to 5, from 29° — 61° at t′ with numbers 1 to 8, and from 37° — 72° at t″ with numbers 3 to 9. There is thus a great overlap between the suggested numerical scale and the existing three-fold groupings vis-à-vis the suggested metric approach (S h a r m a 1961 a: E 111; S h a r m a 1963 a: 1529—1531). This is but expected in view of the great overlap of angular values at t & t′ t′ & t″, and t & t″ (S h a r m a 1964 b: 27) and also because of the "continuous distribution" of angle atd values at t, t′, t″ (P e n r o s e 1954: 10). The following gradation orders are obtained on the basis of the preponderant number of angular values occurring in association with different numerals at different positions of axial triradii:

t - P o s i t i o n : No. 3 (198 cases) > No. 4 (98 cases) > No. 2 (64 cases) > the rest;

t′ - P o s i t i o n : No. 3 (141 cases) > No. 4 (140 cases) > No. 5 (50 cases) > No. 2 (37 cases) > the rest.

t″ - P o s i t i o n : No. 5 (35 cases) > No. 6 (31 cases) > No. 7 (15 cases) > the rest.

By implication, one might say, if the statement that "... application of this technique (Angle a t d with its qualitative value correlations) on a universal basis is fairly dubious and can lead to error" (S h a r m a 1962: 217) is valid, then by virtue of similar reasoning one might also infer (in view of angle a t d investigation being "unnecessary" as proved by G e i p e l in 1961) that application of the proposed classificatory numbers from 1 to 9 for angular values is also unnecessary, may invalid! See Fig. 1 for the association existing between the numerals of the graded scale of angle atd (at t, t′, t″) values and t-position (t, t′, t″).

The value of coefficient of correlation between the angle atd scale on the one hand and the three-fold groupings of the proximo-distal anatomical positions is + 0.384 ± 0.029. In spite of the value of r being + 0.384 (that is less than 0.5), the determination of the proximo-distal positioning of axial triradius (as of now, along with the present writer's metric orientation to assess the said positioning of axial triradius along the longitudinal axis of the palmar print (S h a r m a 1961 a: E 111; S h a r m a 1962: 48—49; S h a r m a 1963 a: 1529—1531), finally leading to the t - I n d e x (S h a r m a 1964 d: 167—170), may rightly be considered a superior device relative to the angle atd investigation. The latter is an unscientific and inferior device simply because it does not achieve the main objective of assessing the proximo-distal position of axial triradius vis-à-vis the longitudinal axis of the palmar print, whereas the present writer's suggested metric approach does succeed in achieving the chief objective (rather admirably) as is clear from the fact that the extent of error when (i) one follows the metric approach in problematic cases only — as I did in an unpublished study (Sharma 1962: 1—503) and (II) on all axial triradii with the set objective of calculating t-Index in each case, is as low as 3.55 % (Sharma 1964 d: 170). The implications for the effectiveness of the suggested metric modification are too obvious to be stated. Any replacement must fulfil one condition, that of minimizing the degree of error to the maximum extent so that the existing qualitative methodological approach is only given a quantitative extension. The metric approach leading to determination of t-Index of the present author is justifiable in this context but not Mavalwala's nine numerical groupings (1 to 9) of Penrose's maximal angle atd values, the numerals being as deficient, inappropriate and poor a replacement of the existing methodological practice as the suggestion by Rife (1958—1960: Point No. 11: 18) that Penrose's maximal angle atd may be adopted as a suitable replacement for the existing practice.

"The tedium of measuring the angle" (Mavalwala 1963: 79) may be done away with if a multipurpose instrument called Direct Angle Measure (Sharma 1964 a: 18—19) is used by those interested in confirming (or rejecting?) my inferences regarding angle atd measure being not synonymous with proximo-distal t-position. The two are different metric expressions: one is the angular width between a & d with respect to t while the other is indicative of proximo-distal positioning of axial triradius relative to two levels DWC & PMPC (see Fig. 1 in Sharma 1964 d: 167); DWC implies the most distal wrist crease while PMPC the most proximo metacarpophalangeal crease. This multipurpose instrument was designed in 1959 when the present writer also experienced the slow progress of work (caused by first drawing the lines a — t and d — t and then measuring the angle a t d) primarily for measuring angle a t d in a more convenient manner without drawing pencil lines, thereby saving the print from being disfigured as well as effecting considerable saving in time; it has the potential usage in all those places where one wishes to take any two linear distances and the angle contained between these two lines simultaneously e.g. in measuring angles, linear distances and proportional indexes (following Valšik's 1933 methods) on the exposed X-ray plates. A more convenient tool is "Linear Coordinate-cum-Angle Measure as already announced (Sharma 1964 e: 20).

The present writer takes this opportunity of pointing out the following:

(I) That Geipel's German sample was "non-Mongoloid", not 'mongol' as alleged by Mavalwala on page 78.

(II) One is also at a loss to understand why Mavalwala (1963: 78) thinks that "the interest in these two studies (Penrose 1954 and Geipel 1961) was primarily to establish an upper cut off level"? In reality, Geipel's (1961: 338) central finding was: "... Applying Penrose's criterion to German persons suspected of Mongolism could bring the danger of taking cases of ∢ atd lying between 56° and 61° for mongoloids" because Geipel (1961: 338), following Penrose's approach on his normal German population, found out "that the same criterion ∢ at″d > 61° concerns a German non-mongoloid (italics mine) population"! Hence, the question of "association with mongolism" in Geipel's non-mongol sample of 216 German palms does not at all exist.

(III) The numerical scale after all corresponds to certain convenient groupings of angle atd and for that reason is as effective or defective a measure as Penrose's maximal angle atd itself.

(IV) It has been alleged that "the main advantage of this numerical scale lies in that the investigators in different parts of the world would come to the same conclusion on a point quite consistently" (Mavalwala 1963: 79—80). The latter attitude is praiseworthy only in as much as it is ingrained with the consciousness of the need for standardization, but this is what is exactly achieved by the writer's own metric orientation suggested first at the II[nd] International Congress of Human Genetic (Rome, 1961 a) to assess the proximo-distal anatomical positions of axial triradii. Since then some clarifications have been advanced (Sharma 1964 d: 167—170) so as to ensure not only the elimination of "personally varying standards" but fairly uniform application of t-Index, an extension of the existing method. Preliminary investigations of t-Index are very encouraging (Sharma 1964 f).

(V) "Considering the relative accuracy of the new method of designing angle atd it is suggested that a closer classification be adopted of 5° intervals with the motive that a smaller interval may bring to light differences between populations that may be obliterated by a coarser classification" (Mavalwala 1963: 78), is an erroneous contention running as it does counter to Penrose's own view preferring the "cotangent scale" and also followed by Penrose in Tables 1—19 in Appendix I (Penrose 1954: 28—34). Penrose (1954: 23 vide Table 7) may be quoted: "... the cotangent of half the angle measured on each hand separately ... tends to make the distributions of unaffected subjects more symmetrical. The intervals in the new scale adopted are arranged so as to make equal steps in the cotangent scale, that is approximately equal perpendicular distances of the point t from the line ad." By sharp contrast to Penrose's "cotangent scale", Mavalwala (p. 78) sticks to "5° intervals" with the false hope that the nine-grade scale of angle atd values is "a finer classification" relative to the three-fold groupings suggested by Penrose from the quantitative standpoint alone, which in its own turn has been explicitly termed "a coarser classification" by Mavalwala (p. 79). Of course, the validity of Penrose's "cotangent scale" will be dealt with elsewhere since it is a separate issue altogether.

(VI) Mavalwala (on p. 79) advocates the elimination of fluctuation in angle atd values with age by resorting to the use of "an adult sample" thereby totally ignoring Penrose's procedure of evolving correction factors both for age and sex (Penrose 1954: Table 21: 27) that can be independently evolved for any Series so as to render comparability of "all subjects (became) equal to males in the age group 5—14 years" (Penrose 1954: 24). To hold the view and advocate that "future investigations reporting on the angle to mention the mean age of their sample" seems irrelevant in this light, especially when one finds the mean age of Mavalwala's Parsi sample missing. The excuse given (on p. 79) is that "... exact ages ... were not recorded ...".

SUMMARY AND CONCLUSION

The value of r between the angle atd scale (indicated by the numerical scale 1 to 9 by Mavalwala in 1963) and the proximo-distal positioning of axial triradius is $+0.384 \pm 0.029$. The proposed numerical methodological approach is as deficient and inappropriate a replacement (of the existing 3 fold practice of adjudging the proximo-distal positioning of axial triradii) as Rife's concept of Penrose's maximal angle atd being a substitute for symbols t, t′ and t″. This contention is especially true if one bears in mind the fact that the existing approach of distinguishing axial triradii has been given a fairly comprehensive metric orientation, by me (1961 a), and this may be, if desired, given numerical expression in terms of a frequency distribution of t-Index (Sharma 1964 d), that is within the framework of statistical treatment.

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$$\left[\mathrm{BHI} = \frac{\mathrm{a-d}}{\text{Perpendicular from ax. tri.}} \cdot 100\right]$$

and Somatic Differences in Human Hand as shown by Palmar-print Form Index (PFI = B/L . 100) and a Methodological Note on Angle *atd* vis-a-vis Different Positions of Axial Triradii. *"Abs. No. 247" in Excerpta Medica Foundation International Congress Series No. 32: E 112.*

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