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HUMAN HAIR ANALYSIS-A FORENSIC PERSPECTIVE

Forensic Medicine

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ABSTRACT

For successful prosecution in all criminal cases there is an absolute need to establish the chain of events beyond reasonable doubt and to the satisfaction of the presiding officers in a Court of law. The significance of fingerprints in personal identification of suspects is well recognized in scientific criminal investigation but with the sophistication of crime techniques by the criminals the chances of latent fingerprints left behind at the scene of crime have become remote hence physical evidences such as hair fibers and their analysis are gaining importance in personal identification and individualization . The present study has been conducted to know the role of human hair in personal identification and Individualization. A total of 25 males and 25 females' hairs were studied and from each sex 625 strands were studied during a 1 year duration at department of Forensic Medicine, Osmania Medical College. It was observed that the variations in the hair were present not only in the male and female gender but also from the same individual. Thus a hair analysis plays an important as an evidence in crime investigation.

KEYWORDS

Human Hair, Crime Investigation, Forensic Medicine

INTRODUCTION:

For successful prosecution in all criminal cases there is an absolute need to establish the chain of events beyond reasonable doubt and to the satisfaction of the Pre-siding officers in a Court of law. To attain this perfection most scrupulous and thorough scientific investigation is of paramount importance. To achieve this end, the investigatory machinery seeks to modernize and sophisticate itself, in the light of recent advances in the various branches of Forensic Science. On the other hand the criminals too, try their best to achieve perfection in committing all the heinous crimes by adopting modern and scientific methods. Thus there is a neck to neck race between criminals and the investigator, the culprit and the judiciary. The significance of fingerprints in personal identification of suspect is well recognized in scientific criminal investigation. [1]

The significance of fingerprints in personal identification of suspects is well recognized in scientific criminal investigation but with the sophistication of crime techniques by the criminals the chances of latent fingerprints left Behind at the scene of crime have become remote hence physical evidences such as hair fibers, Semen and blood found at the scene of crime are gaining importance in personal identity techniques are being developed so that complete individualization employing these materials is brought to the realm of reality. Human hair assumes tremendous importance in crimes of Murder hit and run cases criminal assaults etc where personal identity has to be established to prove certain links with the crime.[2]

Human hair study in this regard especially the value of certain indices namely scale count index, hair index, medullary index etc in the individualization of hair has been investigated by many authors. [3]As Human Hair is a specialized epithelial appendage which occurs on the skin except on the palms, the soles, the nail areas, the vermillion border of the lips and similar regions make it more chances of availability at crime scene [4]. The present study has been conducted to know the role of human hair in personal identification and Individualization.

MATERIALAND METHODS

In the present study 25 males and 25 females are chosen from each of whom 25 strands of random samples of scalp hair are taken and examined. In the case of males the samples are from the medico-1egal autopsy cases. The hairs are cut to the scalp as close as possible. "Combing samples" are chosen from 25 female students of the Osmania Medical College. These samples are preserved in suitably labelled envelopes. Study was conducted during January 201 to January 2017.

Prior to mounting the specimens, the samples are cleansed in equal quantity by ether and absolute alcohol. In the longitudinal mount the maximum diameter, diameter of the medulla and presence or absence of medulla are noted. Cuticular impression is made using 'Camel Adhelin' a locally available gum. Four counts in each strand, 25 strands in each case and 25 such cases each in males and females are studied. Micro-sectioning is done using bunches of hair. A bunch is made consisting of an inch length of hairs, either end being tied with silk thread.

Examination of Hair: In each case the examination is done as per the proforma and the observations tabulated accordingly. The measurements are made by using 'Erma' ocular micrometer disc fitted to a 10 X eye-piece which is calibrated by using a stage micrometer. Each ocular division is found to be equal to 3.6 u in high power i.e., 45 x objective and 10 X eye-piece. All the measurements are made using the same set up of microscope. In the present study a Bausch & Lomb Binocular Microscope is used. All observations are made by a single individual (me) so that the personal error is uniform throughout. Hair index, medullary index, Scale count/108 u and Scale count index are calculated and statistical analysis made. In the present study scale count/108 u is made as 30 occular divisions are found to correspond to 108 u. Scale count index is calculated in the present study as the ratio between scale count/108 microns and diameter of the hair at that place (Diameter/S.C.).

Statistical analysis: Data was entered in the Microsoft excel spread sheet ver 2013.Later exported to SPSS (Statistical package for social science) version 17 (Trial). Descriptive statistics (mean, standard deviation, and range) was calculated for all the important parameters recorded in this study. Qualitative variables like were described in the form of frequency and percentage. Inferential statistics was calculated starting formulating the hypotheses and tested for significance using unpaired t test. A p value of 0.05 or less will be considered as statistically significant.

RESULTS :

In the present study a total of 25 males and 25 females' hairs were studied and from each sex 625 strands were studied.

TABLE 1: Sex Distribution

SEX	No.of individuals	No.of strands studied per individual	Total no.of strands studied
Males	25	25	625
Females	25	25	625
Total	50	25	1250

The values of various indices H.I =Hair index, M.I =Medullary Index, SC= Scale count, SCI=Scale Count Index of males and females were shown in Table 2 and 3

TABLE 2: Values of various indices in Males.

H.I	M.I	Percentage absence of Medulla	SC/108u	S.C.I
82.5	0.216	88	14	7.714
68.9	0.233	80	14	7.42
80.1	0.159	84	13	7.461
79.6	0.206	88	12	8.065
81.4	0.217	88	12	6.6
93.9	0.157	60	15	7.2
83.4	0.161	80	12	6.3
87.5	0.141	88	15	5.04
94.9	0.151	80	14	6.028
86.2	0.196	88	13	6.65
80.6	0.153	80	15	6.24
87.4	0.208	80	15	6
77.8	0.178	64	14	5.142
74.7	0.171	84	12	7.2
87.3	0.187	76	13	6.646
83.8	0.155	52	11	7.2
85.2	0.142	84	13	6.92
87.3	0.198	72	13	7.75
86.6	0.123	92	16	4.05
83.9	0.138	76	13	8.04
86.8	0.162	84	12	8.4
86.9	0.207	72	11	6.22
81.5	0.228	88	12	7.5
81.6	-	100	13	8.04
77.1	0.18	84	10	7.92

TABLE 3: Values of various indices in Females

H.I	M.I	Percentage absence of Medulla	SC/108u	S.C.I
79.1	0.16	88	14	8.74
81.8	0.139	88	14	4.34
80.2	0.155	80	13	4.49
74.6	0.181	76	15	5.52
84.3	0.177	76	14	7.2
80.8	0.116	80	15	7.2
85.4	0.18	76	14	5.6
82.3	0.161	80	14	7.2
71.5	0.227	88	14	6.162
79.7	0.153	88	15	6.72
72.7	0.132	92	11	6.872
81.4	-	100	13	6.923
79.1	0.175	88	14	6.428
85.5	0.125	96	15	6.72
77	0.213	92	15	6
77.8	0.19	92	13	6.923
88.8	0.143	84	14	6.428
85.7	0.162	84	14	6.162
72.8	0.172	84	15	6
73.4	-	100	13	8.307
84.4	0.16	84	14	6.162
86.9	0.25	96	15	8.16
83.3	0.181	84	13	7.2
83.9	0.165	80	14	4.63
75.7	0.178	96	14	9

TABLE 4: Range of values of various Indices in both sexes

Indices	Males		Females		P value
	Mean	S. D	Mean	S. D	
H.I	83.48	5.6	80.32	4.89	0.03 (Sig)
M.I	0.18	0.03	0.17	0.03	0.22 (N.Sig)
Percentage absence of Medulla	80.48	10.41	86.88	7.26	0.01 (Sig)
SC/108u	13.08	1.47	13.96	0.93	0.01 (Sig)
SCI	6.87	1.07	6.6	1.2	0.44 (N.Sig)

The sex differences are significant in Hair index, Absence of medulla and Scale count . Medullary index and Scale count index does not seem to have significant difference between sexes. (Table No.4)

TABLE 5: Individual differences in scalp hair in Males and females

Total number	Number showing significant differences in all combinations for various indices						Over all
		H.I	M.I	S.C	S.C.I	No medulla	
Males (n=25) 600 (25*24)	Total %	302 (51)	162 (27)	144 (24)	223 (37.1)	179 (29. 8)	530 (88.3)
Females (n=25) 600 (25*24)	Total %	372 (62)	94 (15.6)	54 (9)	245 (40.8)	184 (30.6)	532 (88.7)
Total 1200	Combined Average	56.5	21.3	16.5	38.9	30.2	88.5

In males the percentage of individuals having significant difference are 51.0 for Hair index, 31.6 for Medullary index, 48.0 for Scale count, 74.3 for Scale count index and 59.7 for Absence of medulla. Overall either by anyone of the indices are combination of all other indices it is seen that about 88.3% have significant differences among males. On an average in females the significant mutual differences are 62.0 for Hair index, 15.6 for medullary index, and 9 for Scale count/108u. 30.6 % for Absence of medulla. Overall judged by either a single index or by combination of all hair indices studied, about 88.7% of females have distinctive differences among themselves and 88.3% in males .

DISCUSSION:

Human hair gives a very important clue in the detection of a number of crimes. The common morphological factors made use of by the workers in this field to individualize e suspect's hair are its Colour, diameter, scale count, medullation, pigment distribution and so on. Certain physical factors like refractive index, density, birefringence, elasticity, stretch-coefficient etc., are sometimes used while some chemical factors are at times made use of hair .Dr. Harpreet Singh observed the role of root sheath of hair for determination of Sex of a person which is non-invasive. Barr bodies identify female sex and male sex is identified by the presence of fluorescent Y. [5]In the present study Hair index ranged between 71.50 - 88.80 in the case of males and 68.90 - 94.90 in the case of females with averages of 83.90 and 80.30 for males and females respectively. In a study conducted by O.P. JASUJA et al Hair index ranged from 25 to 100, in male scalp hair and 25 to 100 in female scalp hair. [6] In the present study medullary index varies from 0.116 to 0.250 in males' and. 0.123 to 0.233 in females. In a study conducted by O.P. JASUJA et al medullary index ranged from 0.075 to 0.459 and 0.071 to 0.357 in the hair form male and female respectively.[6] Chowdhury studied the medullary index of head hairs and the range of medullary index in his work is 0.1089 to 0.292. [7]In the present study the absence of Medulla is found to range from 76.00 to 100.00 with an average of 77.30 in males and from 60.00 to 100.00 with an average of 87.38. Amit Chauhan analyzed 100 samples including males and females and concluded that medulla was absent in 61.80% of youngsters while it was fragmented in 19.50%.[8] In the present study scale count ranged from 10 to 16 in males and 11 to 15 in females which is similar of the findings in Bhatia's work where the average values of scale count ranged from 10.6 to 14.8 in males and 11.8 to 15.7 in females (per 100 u).[9] In the present study the mean values of Scale Count Index ranged from 4.05 to 8.40 in males and 4.34 to 9.00 in females. Whereas the mean values of scale count index ranged from 6.35 to 10.66 in males and 6.15 to 11.08 in females, in the study conducted by Bhatia. [9] Percentage of individuals having difference in all possible combinations in medullary index is 27 % in males and 15.6% in females whereas in Bhatia study it is 20% in males and 59.7 in the case of females. For scale count the values are 24% and 9% between males and females respectively according to Bhatia the percentage of individuals having significant mutual difference for scale count it is 60 for males and 58.7 for females. For S.C.I in the present study the values are 37.1% of males and 40.8 % of females and according to Bhatia the percentage of significant mutual difference for S.C.I is 54 in males and 49 in females.[9]

Overall, either by anyone or the indices or combination of all other indices it is seen from in the present study be seen that 88.3% of males and 88.75 5of females with a combined average of 88.5% among the total individuals show significant differences from others considering either one or other hair index. Bhatia's analysis that about 91 % have significant differences among males and 94% amongfemales. [9]

CONCLUSIONS:

A study of Scalp hair from 25 males and 25 females is made with a view to find out the morphological differences between the individuals hair based on indices like hair index, medullary index, scale count/unit length, scale count index, and presence or absence of medulla. The sex differences are significant in Hair index, Absence of medulla and Scale count. Medullary index and Scale count index does not seem to have significant difference between sexes .In judging overall individualization by either a single index or by combination of all hair indices studied, about 88.7% of females have distinctive differences among themselves and 88.3% in males. It was observed that the variations were present in between male and female gender but also from the same individual. Thus a hair analysis plays an important as an evidence in crime investigation.

REFERENCES

1. Banerjee A.R. and Bhattacharrya B.: Sex differences in histological characteristics of human hair, Journal of the Indian Academy of Forensic Sciences, 1978; 17(2) : 45.
2. Bhattacharya B: A new method of graphical representation of the variation of hair diameter from root to tip: its role in the determination of site. Journal of the Indian Academy of Forensic Sciences, 1972; 11(1): 21-23
3. Nadia I. Mohammad, Manal G. Abdel Wahab, Amira A. Abdel Azim, Moahmmad E. Abou-Salem and Elham El-Shewy. Human Hair as an Important Tool in Forensic Investigations of Sexual Offences. Naif Arab University for Security Sciences. Accessed on 14th Sep 2017
4. Strengthening the Medico-legal response to sexual violence. WHO, UNODC, STOP RAPE NOW. Accessed on 15th Sep 2017.
5. Harpreet Singh, Gorea RK, Aggarwal OP, Jasuja OP. Determination of Sex from Hair. JPAFMAT, 2004; 4.
6. Jasuja OP, Minakshi MS. A Study of Variations in Some Morphological Features of Human Hair. JPAFMAT, 2002, Vol. 2.
7. Chowdhuri.S. Importance of different indices in the morphological examination of hair .J.Indian Acad.Forens.Sci.1963, Vol 2, 37-41.
8. Amit Chauhan , Navodita Tyagi and SK Shukla. A Study on the Presence of Medulla Types of Hair among the Young Jaat Residents of Western Uttar Pradesh. J Forensic Sci & Criminal Inves; (2018).Issue 4, Vol 10, P 1-10.
9. Bhatia, R.Y.P, Rao, K.V.S and Rao, K.V.: Some aspects of Morphological examination and individualization of human scalp hair, Journal of the Indian Academy of Forensic Sciences, 1972; 11(2): 31-36.