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Differentiation of Cut Pattern on Hair by Using Sharp Cut Tools for Forensic Purpose

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Abstract

Hair is physical evidence recovered from crime scene which is not destroyed by exposure to any environmental conditions like heat, moisture and not even by decomposition. The study of hair is called trichology. Hair is divided into three different layers i.e. cuticle, medulla, cortex. Total 20 hair sample were evaluated for different cutting patterns using different cutting tools. The hair samples were cut with different sharp tools i.e. knife, scissor, Trimmer, sickle, clipper, blade. Differentiation of cut pattern on hair by using sharp cut tools shows different pattern according to tools sharpness. The cut pattern made with the help of knife showed plane cut ending, with scissor showed C-shaped, with trimmer showed deep cut from middle aspect of hair, with clipper showed irregular shaped cut, with sickle it was irregular shaped cut.

Keywords: Forensic hair

Introduction

During the course of forensic science many physical evidences encountered, but the most important evidence recover from crime scene is hair which is not easily destroyed. Human hair has a major role in forensic examinations and considered as class evidence as alone it cannot be used to classify a specific individual. Hair cannot be individualized as like fingerprint. The study of hair is called trichology. Human hair characteristics (e.g., scale patterns, pigmentation, size etc.) vary within a single individual. No single hair can be said to come from a particular individual with the same measure of certainty as fingerprints [1]. Hair is the most common biological evidence found at the scene of crime and plays a crucial role in crime investigations related to the fields of forensic science. In case of violent offences such as murders, assaults, road accidents, rapes etc., hairs are likely to get detached from the scalp and other areas of the body and get transferred directly or from one person to another or on the clothing during the act of a crime. As hairs are transferable and can be transferred from one person to another or subject during physical contact, their presence at a scene of crime can associate a suspect to the offender or offender and the victim to a scene of crime. The type of hair recovered from the crime scene and the conditions and the number of hairs found all are of utmost value as evidences in a criminal investigation [2]. Hair can be defined as a slender, thread-like outgrowth from a follicle in the skin of mammals, composed mainly of keratin. Human hair naturally grows much longer and must be cut periodically to maintain a certain length. It has three morphological regions—the cuticle, medulla, and cortex. The cuticle is a translucent outer layer of the hair shaft consisting of scales that cover the shaft. The medulla is a central core of cells that may be present in the hair, if it is filled with air, it appears as a black or opaque structure under transmitted light, or as a white structure under reflected light can be complete partial or abstract reflected. The cortex is the main body of the hair composed of elongated and fusiform (spindle-shaped) cells. The cortex may contain cortical fusi, pigment granules or large oval-to-round-shaped structures called ovoid bodies. Hair is strongly resistant from decomposition and this property makes hair a nearly ideal type of physical evidence. Like other forensic techniques such fingerprints, handwriting samples and firearms, the scientific comparison of hair has been well established in the forensic laboratory of the world [3]. In addition to morphological analysis, nuclear and mitochondrial DNA investigations can be performed to provide more complete information and irrefutable physical evidences, although they are more expensive and time-consuming laboratory techniques. James Robertson (2017) looks at the historical development of hair examination in the last 100 years as it has been influenced by broader scientific developments that have seen the emergence of analytical sciences, including electrophoresis, and serology replaced by DNA analysis. Martin bonder (2016) compared hair haplotypes from the same donors to each other, to the corresponding buccal swab reference haplotypes and analyzed several fragments of individual hairs. We also investigated the effects of hair color, donor sex and age, mtDNA haplogroup and chemical treatment on mtDNA quantity, amplification success and variation. We observed a wide range of individual CR sequence variation. The reference haplotype was the only or most common (≥75%) hair haplotype for most donors. Their findings supported earlier works that species can be characterized and distinguished through hair structure. Hausman (1920, 1924, 1930, 1944) [4-7] was a pioneer in characterizing mammal hairs and wrote several papers on the microscopy and structural characteristics of hair recovered from crime scene. Hicks (1977) an introductory manual

for the microscopic examination and identification of human and animal hairs for investigation and prosecution of crimes. Deedrick and Koch (2004a, 2004b) developed a manual for identification of human and animal hair from crime scenes. Tridico (2005) reported on the examination and analysis of hair and its application in forensics. Homan and Genowyas (1978) analyzed hair structure and its phylogenetic implications in hetero myid rodents using light microscopy and SEM. Moore and Braun (1983) developed a key to the hairs of the families Soricidae, Vespertilionidae, and Muridae in Tennessee using light microscopy and SEM. Most species could be separated with at least a 95% chance of making the correct identification [8].

Methodology

Collection of samples

The hair samples were collected from 20 female individuals after taking their consent. The females were asked to comb their hairs and thus at least 05 hairs were collected from each female and stored in separate polythene envelopes. All samples were put in serially marked paper envelopes immediately after they collected and then stored at room temperature .Hair samples were cleaned with distilled water to remove dust and debris.

Preparation of Samples: The samples were taken out from the polythene envelopes with the help of forceps and then the cut pattern were made with the help of respective tool as mentioned in Table 1. Then the cut hairs were mounted on glass slides by using glycerol and coverslip was mounted on the hair sample.

Microscopic examination of Hair: The slides were seen in Leica DM 3000 LED microscope at 100 X magnification and the microphotographs were taken with the camera (Leica DM 3000) attached with Leica microscope.

S.No.	Name of tool	Type of cut pattern observed
1.	Knife	Plain cut
2.	Scissor	C shaped
3.	Blade	More pointed towards one side
4.	Clipper	Irregular shaped cut
5.	Sickle	Irregular shaped cut
6.	Trimmer	Deep from middle aspect of hairs

Observation

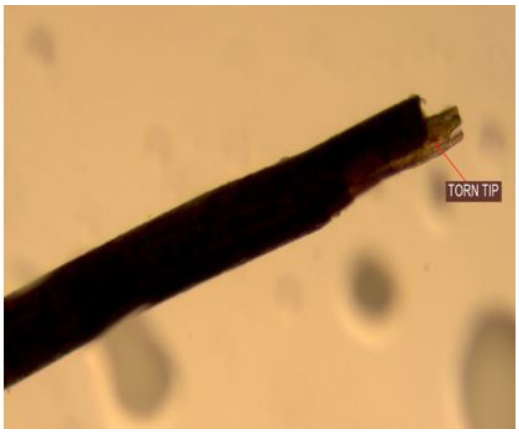

Figure 1: Human head hair torn tip

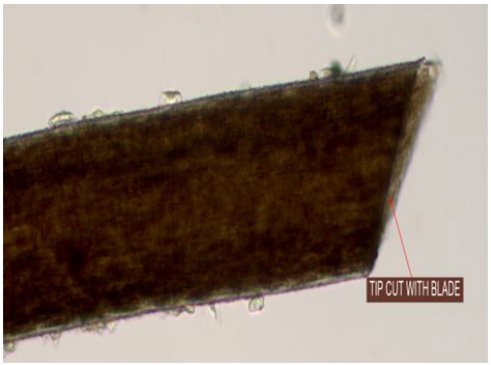

Figure 2: Human head hair cut with blade

Figure 3: Human head hair cut with scissor

Result and Discussion

The purpose of this study was to catalog the characterstics distinguish between the different conditionof cut pattern with sharp tools i.e. sickle hair, cut with blade, cut with scissor, cut with trimmer, cut with clipper, cut with knife of human head hair under the LED microscope. After the microscopical study of human head hair. The results of our study showed that the cut pattern made with the help of knife is plane cut, with scissor is C-shaped, with trimmer is deep from middle aspect of hair, with clipper is irregular shaped cut, with sickle is irregular shaped cut. In human hairs, the medulla is generally amorphous in appearance, whereas in animal hairs, its appearance is frequently very regular and well defined (Deedrick and Koch, 2004a, 2004b; Hicks, 1977).

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