



ROLE OF FORENSIC ANTHROPOLOGY IN PERSONAL IDENTIFICATION

Pooja R. Kulkarni

Research Scholar, Department of Studies in Anthropology, Karnatak University, Dharwad-580003

Jai Prabhakar S. C.

Assistant Professor, Centre for Multi-disciplinary Development Research (CMDR), Dharwad-580004, Karnataka, India

ABSTRACT The aim of the present paper was to study the different anthropometric aspects used for personal identification. It is outcome of different methods used for personal identification specifically in forensic anthropology. Forensic anthropology is the branch of physical anthropology, deals with the identification of more or less skeletonized remains or suspected of being human. Personal identification is determination of individuality of a person in both living as well as in dead. An attempt has been made to understand the relationship between Forensic Anthropology and Personal identification and between them and other methods. Different methods viz. anthropometry, molecular methods (Blood group, Body fluids, DNA), odontology, fingerprint, biometrics, and lip prints etc. helps for the personal identification through the knowledge of forensic anthropology.

KEYWORDS : Personal identification, Forensic aspects, Biometrics, Body fluids, Anthropometry, Molecular methods.

INTRODUCTION

Anthropology is the study of human being through holistic approach. It studies the human beings and its aspects ranging from the biology and evolutionary history of homo sapiens to the features of society and culture that determinedly distinguish humans from other species. Anthropometry is the scientific approach of anthropology through which it obtain a systematic measurement of human body. It was first developed in 19th century as a method used by physical anthropologists for the study of human variation and evolution in both living and extinct populations.

FORENSIC ANTHROPOLOGY

Forensic anthropology is a sub-field of anthropology, deals with the identification of unrecognizable human remains (usually in skeletal form) by determination of age, sex, race and stature. Personal identification means a determination of individuality of a person. Out of four pillars of an individual like age, gender, stature and race, most important two are stature and gender. 'Stature' is one among the most important elements in the formulation of the biological profile in the process of personal identification. The natural disasters like earthquakes, tsunamis, cyclones, floods and man-made disasters like terror attacks, bomb blasts, mass accidents, wars, plane crashes, etc. causes severe destruction may create lot of pain and death in the life of human being. Forensic anthropology helps to identify the individuals from mutilated, decomposed and amputated remaining of the body. Those body fragments are important both for humanitarian and legal reasons. Personal identification can be done through many aspects like Anthropometry, Fingerprint, Lip prints, Biometrics, Odontology and Molecular methods like DNA profiling, Blood groups and Body fluids etc.

ANTHROPOMETRY

Anthropometry is the systematic scale of measuring and recording human body parts. It may be like skeleton, cranium, face etc., by the most reliable means and methods for scientific purpose [1]. The anthropometry in medical science is to help the forensic experts in establishing 'personal identity' in case of unknown human fragments. Stature is important parameters for personal identification of individual. There is a definite relationship between the height of the person and various parts of the body like the head, the trunk and lengths of the upper and lower limbs. Complete identification is nothing but absolute fixation of the individuality of a person. Partial identification means only some facts about the identity of the person while others remain unknown [2]. Stature is the height of the person in the upright posture and establishes an important pillar for personal identification along with gender [3-4]. Similarly, it is the central dogma in the anthropo-forensic examination [5]. Human stature is, therefore, an anatomical complex of linear dimensions [6]. Anthropometric data believed to be objective, and allow forensic examiner to go beyond subjective assessments of 'similar' or 'different'. With measurement data, the examiner can quantify the degree of difference or similarity and state how much confidence can be placed in this interpretation [7].

Various researchers across the arena of forensic anthropology, worked on stature estimation from different body parts of diverse ethnic groups. For example, a study conducted on left and right hands separately on Punjabi males [8], somatometric measurements of the hands on Egyptian subjects [9], estimation of stature from the length of cervical, thoracic, lumbar segments of the spine [10]. Some studies established the relationship on bilateral asymmetry and estimation of stature from arm length and its segments [11], tibial length and stature [12], estimation of stature from seven somatometric measurements on the lower portion of body [13] etc.

FINGERPRINT

Dactylography is a scientific technique of fingerprints and new method for recording, lifting and developing of prints under different field conditions appearing regularly [14]. A fingerprint of an individual is nothing but an imprint left by the friction ridges of a human finger [15]. The fingerprint system based on the principle that the skin of the balls of the fingers and thumbs covered with ridges and grooves; the pattern of which varies between individuals and makes absolute identification possible [16]. In the crime world accurate identification of criminal and crime records are most vital parts of evidences and no two identical fingerprint patterns have reported for over 100 years of criminal records. Even identical twins do not have identical fingerprint [17]. In the case of criminals, impressions of all the digits of both hands preserved for further identification.

CLASSIFICATION OF FINGERPRINTS:

1. Loops (about 60-70%): (a) Radial (b) Ulnar
2. Whorls (about 25-35%): (a) Concentric (b) Spiral (c) Double spiral (d) Almond shape
3. Arches (about 6-7%): (a) Plain (b) Tented (c) Exceptional
4. Composite (about 1-2%): (a) Central pocket loops (b) Lateral pocket loops (c) Twinned loops
5. Accidentals

DEVELOPMENT OF FINGERPRINT IN INTRAUTERINE LIFE:

The study found that fingerprints formed by the development of primary and secondary ridges in the palms and fingers in intrauterine life at first four months of gestation [18-22]. The researchers further elaborated that primary ridges develop first, followed by secondary ridge development or the occurrence of furrows between the papillary ridges. It clarified that there is a link between the ridge pattern and anatomical structures called volar pads. These are protuberances of tissue begin to form on the tips of the fingers about 7th week. It formed at the fingertips, on the distal part of palm between the digits, thenar and hypothenar regions. These volar pads become less prominent after 10th week of gestation period and become disappear in human embryos. Therefore, fingerprint is unique due to its variations in twin babies; it is either dizygotic (fraternal twin) or monozygotic (identical twin) [23]. Therefore, fingerprints can used to distinguish between twins and frequency of identical twins is about 0.4% across different populations [24].

From this point of view, sex-based differences in fingerprint pattern and the density of the finger ridges become relevant. In forensic examination, sex differences in fingerprint ridge density are highly distinctive and forms the basis for personal identification. Studies have showed that females have a significantly higher ridge density than males proved that epidermal ridges are finer and denser in females than males.

FINGERPRINTS AND SCENE OF CRIME:

In general, the purpose of collecting fingerprints is to identify an individual may be either a suspect, a victim or a witness. There are three types of fingerprints, found in scene of crime: latent, patent and plastic or impressed fingerprints. Latent fingerprint is invisible to the naked eye [25] and made of the sweat and oil on the skin's surface. Dusting or chemical agents help to make latent print to be visible. Fluorescent powder is required when dusting for prints at a crime scene, as fluorescent techniques are very sensitive. Therefore, powder leaves the scene much cleaner than when using black powder. To save the society from the criminals and terrorists and to make the lives more comfortable, fingerprint can play a very important role. With advancement of technology, we can enhance more quick and accurate result even from partial print of fingers.

LIPPRINTS

Identification of an individual, living or dead based on the theory that all individuals are Unique. Personal identification becoming increasingly important not only in legal matter but also in criminal investigation. It would also useful in identification in Genetic Research. Another important identity is Cheiloscopy, a forensic investigation technique deals with the identification of human based on the lip prints [26]. Anthropologists first noted the biological phenomenon of systems of ridges on the red part of human lips. Though it described in 1902, anthropology merely mentioned the existence of furrows without suggesting a practical use of the phenomenon until 1950. Uniqueness of lip prints demonstrated that even in twins, whose pattern is somewhat similar, no two lip prints are identical.

BIOMETRICS

Biometrics is not a new slogan in the field of information security. Though it provides high degree of accuracy in identifying an individual, the level of frauds and security breaches has also amplified. Most Biometric Systems are unimodal in nature means they use only one source of information relying only one physiological or behavioral human trait like face, fingerprint, iris, signature, palm prints, gait etc. [27]. In past decades, there have been considerable improvements in reliability and accuracy of biometrics authentication system [28]. However, they are having many problems; some of them are imbibed in the technology itself. The technology of biometrics used to identify and analyze individual's physical and behavioral characteristics. Unimodal biometrics uses only one characteristic to identify a person. However, to overcome the problems of Unimodal biometrics, Multimodal biometric system got its importance, which encompasses more than one traits of a person for the identification, verification and authorization[29].

FORENSIC ODONTOLOGY

The branch of forensic odontology connects both dentistry and the legal profession [30]. In each forensic investigation team, one dentist should be included. In various forensic circumstance, dentists play an important and significant role. However, several dentists and legal professionals are quite ignorant in forensic investigations. Depending on the circumferences, a forensic investigation team may involve law enforcement officials, forensic pathologists, forensic odontologists, forensic anthropologists, serologists, criminalists, and other specialists. Personal identification may also be required to identify both a missing living individual with amnesia and the culprits committing crimes. Dental records of an individual is very important and often play a key role in the personal identification.

The identification of a person is required when the body disfigured or mutilated beyond recognition. It may resulted by barbaric crimes, motor vehicle accidents, aviation and navy disasters, wars, fire, flood, natural mass disasters and causalities. When other structure destroyed, the only source of information for the identification of human remains the teeth. In such situation, forensic odontologist plays a vital role in identification of the person. Teeth are hard stable unique structures with unique shapes and sizes [31]. Teeth not easily decomposed as other body structures even after death. Teeth survive even disastrous

environmental conditions, such as fire, which makes these a trusted source in the identification process[32].

MOLECULAR METHODS

Blood and DNA: Blood is one of the most important biological traces often found on the crime scene. Due to valuable information, it considered very important forensic tool. Analysis of different aspects of bloodstains gives clarity on the circumstances and violent crimes. In such vital data can helps the criminal investigation in the right direction and solve the crime. It can also help with legal determination of criminal offense, which can lead to more accurate and more appropriate direction. To determine the sequence of events during the crime scene, the analysis of blood and its stains helped lot. Proper knowledge and interpretation evidences makes it possible to get closer to the truth. After determining that it is blood by using serological tests, DNA profiles, which account for the donors of different bloodstains are obtained. The sequence of events and mechanisms of creation of bloodstains pointed towards morphological analysis of bloodstains [33].

Serology and DNA Analysis: It is important to determine certain basic characteristics of blood sample prior to start assessing morphological aspects of bloodstains. Serological tests used to verify if a particular red drop on the crime scene is indeed human blood or not. Phenolphthalein test confirms the human blood on different objects and in different areas on the crime scene. To determine the different kind of blood spatter throughout the crime scene, methods of DNA analysis needs to be applied. Even from a very small amount of blood, a meaningful and undoubtedly accurate results can be obtained through DNA tests. The results of analysis confirm that specific bloodstain or spatter is indeed from the victim or from the perpetrator. It would help to make correlation of bloodstains on the crime scene with inflicted injuries from the autopsy report.

BODY FLUIDS

Forensic biology deals with biological evidence and their examination. In the examination of crimes such as murder, robbery, rape etc. the examination of biological fluids play an important roles in connecting criminal with the crime. It uses scientifically accepted protocol to analyze the biological evidence. Biological evidences may be found on clothing, Weapons and other surfaces and they may be in the form of Blood, Semen, Saliva, Urine etc.

Semen: Semen analysis is one of the most popular and informative forensic techniques. It is one of the prevalent body fluid found in crime scene especially in cases involving sexual assault. There are many chemical tests to confirm an unknown fluid to be semen. It found in liquid form, gel like fluid, which liquefies on exposure to atmosphere. Semen sample of an individual is unique. With the classical method, it was not possible to establish the individuality but DNA profiling has made it possible to pinpoint the source of origin even from the tiniest speck.

Saliva: It is a fluid largely composed of water with little amount of electrolytes and enzymes. It secreted by a pair of salivary glands in mouth. On an average, a human being secretes 1.0 to 1.5 liters of saliva every day. This fluid often seen in sexual assault cases. Saliva test can reveal certain diseases. It can be analyzed from various surfaces such as body parts, paper, envelopes, glass bottles and cigarette butts Etc. DNA profiling of saliva stains enhanced the evidential value of saliva stains.

Urine: It is liquid human waste containing water, salts and many small molecules. Urine is aqueous solution with 95% water, 9.3 g/L Urea, 1.87g/L Chloride, 1.17g/L Sodium, 0.750g/L Potassium Etc. It is usual transparent pale yellow solution but color also ranges from colorless to pale yellow. It identified by presence of large amount of urea in it. Urine stains can be individualised through DNA profiling. It can be examined to contribute facts about the crime as well as victim or the suspect.

CONCLUSION

The present paper is an attempt to understand the various anthropological aspects, which are useful in the personal identification (individuality of a person). Forensic anthropology is a subfield of anthropology, deals with the identification of unrecognizable human remains usually in skeletal form by determination of age, sex, race and stature. Different methods like anthropometry, biometrics, fingerprint, lip print and some molecular methods such as blood, DNA analysis and

biological/body fluids helps to determine the identification of person as each individual has his unique feature.

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