ORIGINAL RESEARCH PAPER
Volume-6 | Issue-11 | November-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FORENSIC HUMAN IDENTIFICATION METHODS: A REVIEW

Dental Science

Dr Samarika Dahal Lecturer, Department of Dentistry, Maharajgunj Medical Campus, IOM, TUTH, Kathmandu, Nepal

Dr Nitin Kumar Agrawal* Lecturer, Department of Dentistry, Maharajgunj Medical Campus, IOM, TUTH, Kathmandu, Nepal *Corresponding Author

ABSTRACT

Human identification involves maintaining and protecting the integrity of an individual by correct identification. It is an integral component in innumerable instances such as identity theft, criminal investigations of the dead or missing, mass disasters that need confirmation of human identity. This paper compares and contrasts various methods of human identification that includes both primary and secondary along with a brief discussion on status of dental identification in Nepal. Here, discussion also focuses on the fact that no single factor is an absolute indicator of identity. Thus, multitude of factors can be taken into cumulative evidence for confirmation of an identity.

KEYWORDS

Dental, DNA, Identification, Nepal

Introduction

A Forensic dentist plays an important role in human identification in mass disasters, especially in fires, explosions, decomposing or skeletonised bodies, when there is little material remaining to perform visual identification.[1]

The methods of victim identification can be classified as primary and secondary methods. The primary method utilizes a single technique of identification with 100% accuracy while the secondary method supports the identification but on their own is normally inadequate.[2] The various methods of identification is listed as follows.

Primary methods:

1. Fingerprint evaluation
2. DNA analysis
3. Dental evidence

Secondary methods:

1. Radiography
2. Medical records
3. Skeletal observations
4. Visual analysis of the specimen
5. Miscellaneous:
   Facial reconstruction

Fingerprint evaluation

Fingerprinting is a novel method for identification of the deceased. Several methods proposed for accomplishing prints are reading the prints from the fingertips, making casts of the fingers to create a negative fingerprint image, taking x-rays of the fingers coating with a radio-opaque substance to create a radiograph of the fingerprints and rehydrating the fingertips to the obtain prints.[3]

Fields and Molina in 2008,4 proposed a new simplified method of obtaining the print in which an incision of the medial and lateral finger is done for the removal of the finger pads, after which a transverse incision is given approximately 5 mm below the distal inter-phalangeal joint. Forceps are then used to securely grasp the lower edge of the finger pad to retract the finger pad by cutting the underlying tissue with a pair of scissors. The finger pad is massaged under warm running water for its rehydration. The pad is then dried and placed on the top of a gloved finger in preparation for printing. The finger pad is then inked and a print lifted onto the fingerprint form using the standard method.

Though fingerprinting is an accurate and economic method of identification, it has limitation of mandatory existence of ante mortem record for comparison & recognition. Another important consideration includes difficulty in lifting the finger printing from the mummified bodies.[4]

DNA Analysis

DNA profiling is considered as 'gold standard' for human identification but it has few limitations. The typical sample with expected higher levels of DNA preservation are teeth (primarily molars due to the feasibility of abundant pulp extraction) and dense cortical bone (femur and sternum). However, sampling from the femur may damage external features of value to age and sex estimation, as well as cortical bone used in radiological estimation of age.[5] Even aortic tissues can be used for non destructive extraction of DNA which is a much easier than bone or tooth.[6]

There are two methods of DNA matching classified as direct and kinship. The direct method compares DNA extracted from unidentified human remains to DNA from biological material (direct sample) found on personal items (toothbrushes, hairbrushes, razors, or pieces of clothing). A match occurs when the genetic profile from the human remains and from the biological material is identical. The kinship method compares DNA profiles from human remains with DNA profiles of known biological relatives of victims (reference samples).[7]

This identification method relies upon identifying DNA markers that are shared among the reference samples and the human remains. This method works well when DNA samples are available from close relatives. [7] This is one of the most accurate method of identification however, inappropriate for developing country like Nepal due to its high cost value. The other limitation includes difficulty in obtaining the sample, if the body has been there for quite some time and mummified. There is also high chance of contamination obscuring DNA extraction.

Dental evidence

Classical methods for forensic dental identification are the clinically used radiological documentation techniques such as dental periapical radiographs, bitewing films, and panoramic radiographs. A novel method in dentistry is computed tomography (CT) of the teeth.[8]

The exceptional characteristics of teeth that qualify them as superior in identification are resilience and ability to withstand temperatures (up to 400 °C). Thus they are available for examination even in extremes of conditions. This uniqueness of dentition can be easily utilized for the identification of an individual by comparative analysis of ante and post-mortem dental records and radiographs. The distinctive features that marks any dentition distinctive are teeth arrangement, shape of the crown and roots, malocclusion, extra teeth, missing teeth, various types of fillings in different types of teeth, pathologies, developmental anomalies, root canal procedure, artificial teeth and tooth wear.[9]

Radiography

Radiological identification of human remains is based on matching of unique findings on post-mortem images to be matched exactly with ante mortem images of the individual. Various scientists have proposed various parameters for comparison such as tooth, frontal

sinuses etc. The two-dimensional radiograph, still remains as the method of choice for the examination of the skeleton. Computed tomography (CT) scanning can be used to scan the entire body in seconds, and images can be reconstructed in any plane: axial, coronal, sagittal, or oblique. This ability of CT scanning to undertake 3D and multi planar reconstructions offers the opportunity to examine the underlying skeletal structure of fleshed remains, visualizing trauma, degenera¬tive processes, and articular surfaces and taking accurate measurements.[10,11]

Though this method is quite efficient in establishing presumptive identification, requires expensive equipments and instruments. However dental radiography can be quite cost effective and accurate for establishing identification. Within dental radiography there is no minimum number of features required for positive identification[12, 13]. Thus in my opinion odontological means still remains one of the major primary methods of identification.

Medical Records

Medical records are useful means of verifying an individual especially if the implanted surgical devices has serial number imprinted on it and are available to match.[14] The limitation of this method is compulsory availability of ante mortem records for matching.

Skeletal Observations

Physical anthropologists can estimate the stature by direct measur ement from non-fleshed human remains or by using radiological methods. CT scan can provide highly accurate measurem ents. Determination of sex can done by examining skull and mandible, the distal end of the femur, and the ratio of long-bone length. For the differentiation of sexes the particular, shape, size, and geometry of the pelvis, skull, and mandible, foreman magnum can be used.[15] However, the skeletal examination can only act as an adjunct. It definitely needs additional primary methods of identification for definite matching.

Facial Reconstruction

3D computerised forensic facial reconstruction of the skull can be done. It is based on the principle of using a common set of points for linking the anatomical landmarks to describe the individuals [17]. However, this method necessitates expensive equipment, which only does presumptive and not accurate identification.

Current scenario of dental identification in Nepal

Dental identification is one of the most commonly used methods for identification in Nepal. It is easy to perform, cost effective and a single unique feature is sufficient for identification. However, the comparison needs mandatory availability of the ante mortem records, which can be problematic due to absence of dental record keeping in this country.

For the first time in Disaster Victim Identification (DVI) in Nepal, dental identification was carried out. Sixteen out of nineteen victims were positively identified by dental comparison.[18] Similarly in 2016, Agrawal et al., identified two mummified bodies from an avalanche in Nepal by dental means.[19]

REFERENCES

1. da Silva RH, Sales-Peres A, de Oliveira RN, de Oliveira FT, Sales-Peres SHDC. Use of DNA technology in forensic dentistry. J Appl Oral Sci 2007;15(3):156-61.
2. Identification Process – Good Practice: Review: 08/08/14; UK Missing Persons Bureau.
3. Kahana T, Grande A, Tancredi DM, Penalver J, Hiss J. Fingerprinting the deceased: traditional and new techniques. J Forensic Sci. 2001;46(4):908-12.
4. Fields R, Molina DK. A novel approach for fingerprinting mummified hands. J Forensic Sci. 2008;53(4):952-5.
5. Guimaraes MA, Soares-Vieira JA, Silva RHA, Evison MA. A standard procedure for accommodating forensic anthropological and genetic analysis of decomposing human remains from tropical climates. Forensic Science International: Genetics Supplement Series. 2009;2(1):165-166.
6. Sato Y, Hayakawa M, Nakajima T, Motani H, Kiuchi M. HLA typing of aortic tissues from unidentified bodies using hot start polymerase chain reaction-sequence specific primers. Leg Med (Tokyo). 2003;5 Suppl 1:S191-3.
7. Parker LS, London AJ, Aronson J. Incidental findings in the use of DNA to identify human remains: An ethical assessment. Foren Sci Inter: Genetics. 2013;7(2):221-229.
8. Thali MJ, Markwalder T, Jackowski C, Sonnenschein M, Dirnhofer R. Dental CT imaging as a screening tool for dental profiling: advantages and limitations. J Forensic Sci. 2006;51(1):113-9.
9. Shafer AW, Hine MK, Levy B, Rajendran R, Sivapathasundharam B. Shafer's textbook of oral pathology.
10. Thali MJ, Yen K, Schweitzer W, Vock P, Ozdoba C, Dirnhofer R. Into the decomposed body-forensic digital autopsy using multislice-computed tomography. Forensic Sci Int. 2003;134(2-3):109-14.
11. Leo, C., O'Connor, J. and McNulty, J. (2013). Combined radiographic and anthropological approaches to victim identification of partially decomposed or skeletal remains. Radiography, 19(4), pp.353-362.
12. Rocha Sdos S, Ramos DL, Cavalcanti Mde G. Applicability of 3D-CT facial reconstruction for forensic individual identification. Pesqui Odontol Bras. 2003;17(1):24-8..
13. Jackowski C, Aghayev E, Sonnenschein M, Dirnhofer R, Thali MJ. Maximum intensity projection of cranial computed tomography data for dental identification. Int J Legal Med. 2006;120(3):165-7.
14. Dolinak, D., Matshes, E. and Lew, E. (2005). Forensic pathology. Amsterdam: Elsevier Academic Press. pp; 557
15. Adams B and Byrd J; Commingled Human Remains Methods in Recovery, Analysis, and Identification; Chapter 9 - Estimating the Number of Individuals Represented by Commingled Human Remains: A Critical Evaluation of Methods, Pages 193-220
16. Ventura F, Portunato F, Pizzorno E, Mazzone S, Verde A, Rocca G. The need for an interdisciplinary approach in forensic sciences: perspectives from a peculiar case of mummification. J Forensic Sci. 2013;58(3):831-6.
17. Berar M, Tilotta FM, Glaunès JA, Rozenholc Y. Craniofacial reconstruction as a prediction problem using a Latent Root Regression model. Forensic Sci Int. 2011 Jul 15;210(1-3):228-36.
18. Dahal S, Agrawal NK, Shrestha PK. Role of dentists in Disaster Victim Identification of Sita air crash, Nepal. J Inst Med. 2014;36(2):97-101.
19. Agrawal NK, Dahal S, Wasti H, Soon A. Application of Ultraviolet Light in Dental Identification of Avalanche Victims. J Nepal Health Res Counc. 2017;15(2):193-6.