Skull-Photo Superimposition: A Remedy to the Problem of Unidentified Dead in Malaysia

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ABSTRACT: Skull-photo superimposition continues to be a popular method for suggesting individual identification of unidentified human remains. In spite of the popularity in many countries, this method is not in regular practice in Malaysia. Computer aided Video Superimposition Device has been fabricated for the first time in Universiti Sains Malaysia paving the way for skull based identification in Malaysia. In Malaysia, about 25% of the skulls preserved in Hospital Pulau Pinang and among the human remains buried or cremated in two hospitals in Kuala Lumpur are found to pertain to cases of equivocal death and/or possible homicide. As of now, DNA based identification has been resorted to in about 10% of the bodies buried or cremated in the hospitals in Kuala Lumpur and the rest continue to remain unidentified. At present these cases remain as cold cases. The record of missing individuals in PDRM, Malaysia indicates about one thousand of the missing individuals to continue to be untraced every year. It is proposed that a) a skull photo superimposition facility be established in Forensic Science Laboratory, Kuala Lumpur for regular use to identify the dead bodies where the cause of death is equivocal since such identifications are known to bring to light motives in homicides and b) a Central Identification Laboratory similar to VICTIM project of FBI be established in Forensic Science Laboratory, Kuala Lumpur for suggesting possible identification of all unidentified remains utilizing the face photographs of missing individuals placing Malaysia on par with the countries pioneering in human identification elsewhere.

Keywords: Forensic anthropology in Malaysia, skull-photo superimposition, identifying the unidentified dead, missing individuals

Introduction

Skull-photo superimposition is an accepted scientific method for suggesting individual identification of unidentified human remains such as recovery of skeletonized remains, decomposed or dismembered bodies as found during routine criminal investigation, mass disasters, bodies subjected to shearing forces as in explosions, burnt or charred remains etc. [1-14]. This method relies on the use of commonplace evidence, face photographs of missing individuals for comparing with the skulls recovered from human remains which render its applicability both popular and effective. Ever since the premier acceptance of skull-photo superimposition based identification in the court of law in England [1], this method had gained legal acceptance in most of the countries [1, 2, 9, 16-22] including Malaysia [23-24]. The use of face photographs of missing individuals bestows on this method the advantage of being effective in situations where blood relatives of the suspected dead individuals cannot be located due to lack of tentative identity thereby hindering DNA based identification. Although skull-photo superimposition has acquired popularity in most of the countries [1-32], yet this method is not regularly practiced in Malaysia.

The problem of unidentified dead bodies has been well documented in forensic science [10-14, 34-39] and skull-photo superimposition has been indicated as a possible solution by recent workers [11-14]. Unidentified dead bodies, including those in which cause of death is equivocal, are not infrequent in Malaysia. In the absence of facility for skull based identification, these dead bodies continue to remain unidentified and are being disposed off as such which may lead to dead end in the investigation process. Since it has been found that establishing identity leads to unraveling the motive in cases of homicides, it is proposed that introduction of anthropological methods such as skull-photo superimposition and photo-photo comparison in Malaysia may provide lead to further investigate some of the cases that otherwise remain as cold cases.

Relevance of Skull-Photo Superimposition as an Identification Technique

The popularity of skull-photo superimposition as a method for identifying the dead by the FBI in the USA recorded its peak utility during the nineties and this appeared to reflect the availability of the necessary equipment and expertise coupled with the awareness of the value in forensic science and law enforcement communities; this utility diminished as molecular approaches have increasingly become available and anthropologists are optimistic expecting photographic superimposition in forensic science to increase [40,41]. In tune with the above optimism, most of the European countries [9-15] and those in the east [31-32] are continuing the utilization of skull-photo superimposition. Albeit the lack of appropriate man power, shifting to molecular techniques for human identification may appear befitting the western countries where dental records form the prime source for identification. However, in countries like India where dental records are seldom maintained, skull-photo superimposition continues to be in regular practice from as early as during 1960. As stated by Ubelaker [41], the first author found a trend that recorded an increase in the utility of skull-photo superimposition from 15 cases during the period from 1971-1975 to 412 cases during the period from 1996-2000 [33] to align with the availability of man power and equipments coupled with awareness on the part of the investigating officers.

Lack of appropriate maintenance of dental record is a common problem in India (project) and the south East Asian countries [9, 38, 39] including Malaysia. Furthermore, during the victim identification in Thailand following tsunami, among the western victims 85.5% were identified using dental records and 0.4% using DNA prompting the observation that DNA based identification encountered certain practical problems relating to decomposition and the time involved [39]. On the other hand, about 73% of the locals among the Thai victims still remained unidentified and their bodies were being exhumed until 2006 [40], the major reasons being lack of dental records and the high cost of applying DNA techniques. Recently, researchers have stressed the grounds for morphological analysis instead of solely relying on DNA based identification [13, 41, 42]. Under these circumstances, for Malaysia and other south East Asian countries, resorting to DNA technology for identifying human remains would not obviate the need for applying conventional anthropological measures such as skull-photo superimposition.

Reliability in Skull-Photo Superimposition

In a survey on superimposition and reconstruction, Aulsebrook and Iscan [43] indicate that the credibility of superimposition system was shown by using it on human remains collected by the Smithsonian Institute by Ubelaker et al [44]. Scientific verification on the reliability of photo superimposition method has been attempted by many researchers [26,32,45-47]. Among the above researches, the work of Austin-Smith and Maples [46] who verified superimposition using one skull with multiple photographs found a chance of about ten per cent wrong match between a skull and an unrelated photograph. However, Austin-Smith and Maples [46] used a 12 inch TV monitor and hence did not evaluate fitness in 'life size'. Furthermore, these authors did not apply anthropological measurements from the skull for bringing out the life size of the face photographs.

At present, cranio-facial morphanalysis, an additional procedure suggested for enhancing reliability [8,33] is also being used for verifying the reliability. Preliminary studies (unpublished) in Universiti Sains Malaysia indicate an enhanced reliability in skull photo superimposition. It has been indicated that craniofacial superimposition can be considered reliable provided multiple criteria are used for comparison [9]. The best measure of a success of a method being court acceptance, it is seen that the superimposition method had gained acceptance in the courts in many parts of the world as a method for suggesting identification. As had been stressed by many authors, this method cannot generate 'definite' identity [1-9]. It is well to remember the instructive guideline of Thomas Dwight that 'absolute certainty' is not the objective in anthropological identification [40]. Rather, the expert is required to assist in establishing the identity and it would be for the judge to confirm it. Thus, the court acceptance of this method is an endorsement on its reliability for application in the context of identifying the dead.

Court Acceptance: International Scenario

Identification of human remains using skull-photo superimposition method has gained acceptance as evidence in the courts in England, Australia, Hong Kong, Japan and Malta [9]. Hagemeier [16] described the video superimposition based identification of a skull by Helmer and Gruner during 1976, which gained acceptance by the Frankfurt Assize Court. Krogman and İşcan [3] point out that the video superimposition based identification established by İşcan was accepted as evidence of positive identification in one case

during 1980. Nickerson et al. [19] cited Brown et al. [20] wherein Australian Court has accepted video superimposition as an identification tool. McKenna et al. [21] reported the acceptance of identification by superimposition in the High Court of Hong-Kong. Other countries where courts are accepting superimposition as evidence include France [17] Uruguay in South America, Switzerland [9] and India [1, 8, 18, 22]. The first author had testified on skull-photo superimposition in the courts of Tamil Nadu, India in 211 instances during the ten year period from 1994 to 2004.

Skull-Photo Superimposition: Court Acceptance in Malaysia

Acceptance of identification of human remains using superimposition in the courts in Malaysia has been mentioned in three instances, two in a student's project report [24] and one in Criminal Law Journal [23]. In all these instances, the superimposition is indicated to have been carried out by Prof. Dr. Masatsugu Hashimoto, University of Tokyo, Japan. However, scientific details on the type of equipments, anthropological parameters used or the laboratory where the superimposition was carried out etc. are not available. On the other hand, the available records indicate the paucity of local expertise as well as equipments in Malaysia for carrying out skull-photo superimposition and that Malaysia had been depending on foreign expertise for tendering evidence in courts law when necessity for identifying by superimposition method arose.

Skull-Photo Superimposition: State of the Art of Research in Malaysia

Pertaining to the application of skull-photo superimposition in Malaysia, identification of a charred skull based mainly on the recovery of part of a 'Chanel' ear ring has been reported and skull-photo superimposition has been mentioned although superimposing images or the details of the methodology have not been provided [48]. An article on superimposition published in Malaysia indicates the use of Furue's method wherein two mirrors are used for producing the superimposition effect [49]. Furue's method has been stated as the choice for the above study as it was inexpensive. It has to be mentioned here that the experts who had been researching on superimposition for application purposes in the courts law from early eighties till recent times [3-16,19-22,25-33] had been using video-vision mixer for producing the superimposition effect of high quality and of desired types and mirror based image mixing would not serve such purposes. Another research on craniofacial analysis in Malaysia related to developing craniofacial database for Malaysia population, an aspect not related to individual identification in forensics [50].

Skull-Photo Superimposition Facility in Malaysia

The Computer aided Video Superimposition Device (CAVSID) (**Fig. 1**) fabricated in Universiti Sains Malaysia is the first of its kind in Malaysia. The device consists of two high resolution (600 pixel) CCD video cameras (Bosch) with Fuginon TV Zoom lens (Manual: 1.2/12.5-7.5) enabling zooming the images in focus locked state for capturing high resolution images of the skull and face photograph. A digital video vision mixer (Panasonic-G-MX70E) that enables real time capture of the images in analogue form is connected to the cameras. The images are cast in a 32 inch LCD TV monitor for analyzing and recoding the measurements with least error as well as for assessing the match between the skull and face photograph during positioning the skull or in process of mixing and wiping the superimposed images. A remote-controlled pan and tilt device (CS Lilin, PIH-303 Model) to which the universal skull clamp is fabricated to be held on stand is used for manipulating the various movements of the skull for achieving the desirable positioning in correspondence with the posture of the face. Control unit for the pan and tilt device (PIH-301-C (24VAC/240VAC) that enables finer movements of the skull and is positioned in a location from where the various movements of the skull for achieving the desirable positioning can be effected. A VCR (Sony-SLV-C317PS) for recording the real time analogue images generated during the superimposition process. Alongside, a 22 inch LCD computer monitor (Samsung) connected to computer system provided with video capture software (Compro) is used for capturing the superimposed images both frame by frame or as video strip.

Fig. 1: Computer Aided Video Superimposition Device (CAVSID) fabricated in Universiti Sains Malaysia, the first of its kind in Malaysia.

The captured images are printed in black and white using a laser printer (1200 pixels resolution). The minimum distance between the skull and the video camera can be 1.2 m, and a similar distance is maintained between the "life size" face photograph and the other video camera. Two improvised vertical stands are used for affixing the enlarged face photograph and, the servo assisted pan and tilt device supporting the skull can be fitted into another improvised vertical stand. These stands are provided with soft dark blue velvet cloth background for avoiding shadow and scattering of light. Diffuse fluorescent light from two 40 w tube lamps positioned 2.3 m in front of the skull at a height of 0.75 m above the level of the skull is used for illumination for the skull as well as the face photograph.

The Problem of the Unidentified Dead: International Scenario

In Milan, Italy, during the 14-year period from 1995 to 2008, a total of 454 cadavers were received as unidentified out of which positive identification could be achieved for 62%. The mean unidentified dead per year was 32. Roughly 50% of the unidentified bodies were identified within 3 days [15]. The authors list the most frequently methods used in decreasing order as follow: visual, fingerprints, soft tissue personal descriptions, information from respective consulates, forensic anthropology, forensic odontology and DNA. In Denmark, during the period from 1992-1996, a total of 89 unidentified dead bodies were received in the three forensic institutes and 79 of them (88.76%) were subsequently identified; the methods in decreasing order being: personal effects, dental examination, multiple sources such as X-ray, tattoos, fingerprints etc. [10]. In France, during a six year period from 2003 to 2009, a total of 134 unidentified bodies were received of which 10.2% remained unidentified after all efforts. These authors indicate that about half of the bodies were inhumed with identity that was not scientifically proved [16].

The Problem of the Unidentified Dead: Malaysian Scenario

In Malaysia the second author had preserved 20 unidentified skeleton remains with skulls in appropriately dealt facilities anticipating the future

identification since the cause of death was either equivocal or indicating homicide. Forensic science graduates from USM now serving as science officers in a few other hospitals have initiated preservation of skulls from unidentified bodies although comprehensive data for entire Malaysia is unavailable. During the 10 years period, between 1999 and 2008, in two hospitals in Kuala Lumpur (HKL and UMMC) the total number of unidentified dead bodies that have been buried or criminated was 411 and in about 116 of them cause of death was either in determinable or indicating homicide [24]. DNA based identification had been attempted in 12 of the 411 cases. Most of these bodies have been indicated as 'fresh' and there is no record whether it meant identifiable appearance of the face since bodies can be classified as fresh even in the presence trauma etc. in the face that may hinder visual identification. Records relating to subsequent identifications, if any, among the above 411 cases are not available [24].

Comparison of the data published from other countries [10,13,16] indicates that the unidentified remains and those remaining so are considerably more in Malaysia (**Table 1**).

While subsequent identification is higher in other countries, in Malaysia the available data does not indicate subsequent identification. Suffice is to say that anthropological means for identification are prevalently used in other countries [10-16] while such facilities have not been established in Malaysia so far. The data on the missing individuals available in PDRM, Malaysia indicates that about thousand missing individuals continue to remain untraced every year (**Table 2**).

Table 1: Comparison of the annual mean among the unidentified dead and rate of identification

Country	Period of study	Unidentified bodies (annual mean)	Percent identified
Milan, Italy [15]	14-year period from 1995 to 2008	32	62%
Denmark [10].	5-year period 1992-1996	18	88.76%
France [16].	6-year period from 2003 to 2009	22	89.8%
Malaysia [24]	10-year period from 1999-2008	41	---

Table 2: Data on missing individuals; traced and remaining untraced (PDRM, Malaysia)

Years (5)	Total number of persons reported as missing		Total number persons traced alive		Total number of persons that remained missing	
	Male	Female	Male	Female	Male	Female
2004-2008	4,622	10,528	2,633	6,645	1,989	3,883
	15,150		9,278		5,873	

The Need for a Victim Identification Center in Malaysia

Based on the available statistics, it may be premature to conclude that all the cases indicated as unidentified continue to be so till now. It is possible that some of these cases had been solved in the intervening period. It is necessary to have a body for monitoring the progress in the identification process so that the actual state of these cases would be brought on record. In spite of the above allowance for the statistics, it is fairly evident all the bodies had been buried/cremated as unidentified occur more frequently and in about 28% of these bodies the cause of death was equivocal. It is also evident that compared to the other countries, the rate of identifying the dead in Malaysia is considerably low. On the other hand, many face photographs of missing individuals are being routinely publicized in the media every day in the hope that some of them may be recognized by the public leading to identification of the missing individuals, if he/she has been seen alive.

It is a fact that new photographs of missing persons are being publicized every day and those that have not been traced remain archived without much scope for tracing. The above two ventures, first, trying to establish identity of the unidentified remains, and, second, attempting to trace those missing individuals utilizing media publication of their face photographs, are both procedures that presently remain dichotomous in Malaysia. As such, there is scope in Malaysia for envisaging a scientific project similar to the VICTIM project in FBI for identifying the dead using anthropological methods that would include skull-photo superimposition and photo-photo comparison so as to relate the skulls or the photographs of the dead bodies with the archived face photographs of the missing individuals for bringing out possible identification, if any.

The project proposed here envisages i) collection of face photographs of all the unidentified dead taken by the investigation officers and ii) preservation of skulls from all the unidentified human remains where there is no lead on identity and forwarding them to the Central Identification Laboratory that would be a part of the Forensic science Laboratory. All the face photographs of those missing individuals who remain untraced would also be forwarded to the Central Identification Laboratory with details on personal particulars. Two major identification ventures in the Central Identification Laboratory would be a) to compare the skulls retrieved from the dead with the face photographs of the missing individuals taken while alive and b) to compare the photographs of the dead with the photographs of the missing individual taken while alive. The outcome will be suggesting possible identification. Identification so suggested can be further followed up for DNA based identification wherever possible. Standard procedure recommended for photo-photo comparison [51] will be used for studying the photographs and a Computer Aided Skull-photo Superimposition Device (CAVSID) similar to the one recently fabricated in the Universiti Sains Malaysia will be used for suggesting skull based identification. Once the identity is suggested through a scientific method, it will provide a strong investigative lead that may further unravel a motive and thus bring to light some of the homicides that currently remain buried without any recourse. In case of implementing this project, Malaysia would prove a pioneer in the South East Asia in utilizing anthropological methods for solving the problem of the unidentified dead.

Conclusion

Unidentified dead bodies are posing a challenge that has been well reckoned internationally. In the context of lack of dental records or DNA samples from siblings, the only other option would be resort to the conventional anthropological methods like skull-photo superimposition. Lack of facilities for skull-photo superimposition in Malaysia may prove a void in the identification process. In the absence of a method for skull based identification, unidentifiable human remains would continue to remain without identification leading to dead end in the investigation process. Furthermore, this method has potential use in utilizing the photographs of missing individuals for suggesting possible identity using skulls recovered from unidentified dead bodies in routine identification of the unidentified dead in ventures similar to victim identification in FBI as well as in mass disaster victim identification. Describing the Computer Aided Video Superimposition Device fabricated for the first time in Malaysia in Universiti Sains Malaysia, it is proposed that skull-photo superimposition be introduced and popularized in Malaysia alleviating the problem of the unidentified dead in Malaysia.

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