

ROLE OF FORENSIC ODONTOLOGIST IN DISASTER VICTIM IDENTIFICATION

^{1*}Manoj Prabhakar, ²Preethi Murali, ³Sivapathasundharam B

¹Assistant Professor, ²Associate Professor, ³Professor and Head,

¹⁻³Department of Oral Pathology, Meenakshi Academy of Higher Education and Research,
Faculty of Dentistry, Meenakshi Ammal Dental College, Chennai, India

Email: ^{1*}drmanoj.oralpathology@madch.edu.in, ²drpreethi.oralpathology@madch.edu.in,
³profhod.oralpathology@madch.edu.in

***Corresponding Author**

ABSTRACT: *Disaster is an event of serious magnitude causing severe damage to life and property. It could be natural, accidental, industrial or man-made. Mass disaster management comprises a team of civil and medical experts who are responsible for investigation and identification of the remains. The central role played by the forensic odontologist in victim identification has changed in recent years, due to the advancement in the field with improved chances of victims being identified beyond recognition. The role of the forensic odontologist includes criminal investigation using bite marks, ante-mortem and post-mortem dental records and DNA analysis using saliva. Recent molecular biological method like dental DNA fingerprinting has taken forensic dental investigation a step ahead in the ladder of victim identification. Even though the role of a forensic odontologist is highlighted in many domains and researches, under whom are they organised and when are they invited in the scene, remains uncertain for a medical/dental professional. This review will therefore provide an 'eye of a needle' perspective about the position of forensic odontologist in Disaster Victim Identification team and their significant role played during any such event.*

Key words: *Disaster victim identification, Mass disasters, Forensic odontologist*

INTRODUCTION

Disaster can be defined as: "A sudden ecologic phenomenon of sufficient magnitude to require external assistance"^[1] or "a serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using its own resources."^[2] A disaster can be natural (geophysical, meteorological, hydrological, climatological, biological) or man-made (accidental, industrial, criminal). It can also be categorized as open (major catastrophic event with no prior records) and closed (aircraft crash with passenger list) disasters.^[3,4] A tremendous number of lives are lost every year by traumatic experiences in such of these incidents resulting in a substantial amount of unidentified victims, which in turn demands the forensic science come into play for the identification of such victims.^[5] Forensic identification is an integrative team effort that involves the collaboration and functioning of law enforcement officials, forensic pathologists, forensic odontologists, forensic biologists, geneticists, forensic anthropologists, serologists, criminalists and other specialists.^[6] Forensic odontologist is one of the key specialist deputed by Interpol DVI (Disaster Victim Identification) to identify mass casualty victims in all the four phases of victim identification - Scene, Postmortem, Antemortem and

Reconciliation. In the global scenario, forensic odontology has become inherent to the identification protocols in most of the countries, with dentition being the essential method of disaster victim identification in addition to friction ridge analysis and DNA profiling.^[7] Despite of having such significance, the practice of forensic odontology and the role played by the forensic odontologist in disaster victim identification seems to be a 'particle in galaxy' in country like India. Unlike other developed countries, there is lack of standard operating procedures and guidelines to be followed during any mass disasters in India.^[3] Irrespective of constituent guidelines and protocols, the purpose of forensic odontologist in disaster victim identification can be made effective by imparting the knowledge and awareness among the general dentists in India. It is equally important for the general dentists to know, where the forensic odontologists are placed in the DVI team, when exactly they have been called into the scene of identification and the role played by them during identification. As a loop in the coil, it is mandatory that the general dentists be aware of the process involved in DVI for self-increase in the standard of knowledge as well as for communication with the common man. This article is an attempt to highlight the part played by the forensic odontologist in disaster victim identification, its shortfalls and recommendations that can be implemented for faster and reliable victim identification in mass disasters, especially in country like India.

MASS DISASTER AND THE IMPORTANCE OF DISASTER VICTIM IDENTIFICATION

Mass disaster, also termed as Multiple Fatality Incident (MFI), evokes images of a chaotic event, initiated by a destructive force, which results in numerous deaths necessitating identification.^[8] The definition of mass disaster is both institutional and location based, which describes, any situation where the fatalities outstrip the capacity of the local morgue and available personnel.^[9] A mass disaster can be natural (earthquakes, floods, tsunamis and hurricanes), accidental (transportation, industrial and mining accidents), and criminal (terrorist act and mass suicide).^[10] India, due to its geo-physical and geo-climatic conditions, is always susceptible to disasters which are either natural or man-made and sometimes combination of both. Statistical database provided by the Disaster Management in India portrays that approximately 16,389 lives were lost in 2004 Indian ocean earthquake, 20,005 lives in 2001 Gujarat earthquake and 9,748 lives in 1993 Latur earthquake.^[11] It is an act of unjust if we eradicate the moments of massive north India floods affecting the areas of uttarkhand in June 2013, which had taken almost 2800 plus lives (death toll still incomplete) and also India- Pakistan floods in September 2014, affecting the areas of Jammu and Kashmir, with the death toll of 500 plus lives. Apart from these natural disasters, accidental disaster like Kumbakonam school fire tragedy in 2004 with the death toll of 94 children, criminal disaster like 26/11 Mumbai terrorist attack which had taken 164 lives and recently a building collapse in Chennai, TamilNadu, in the year 2014 with the death toll of 61, had been intermittently taking place in different parts of the country. Personal identification is always a challenge in any of these mass disaster events. Victims of major disasters are identified on the basis of the degree of damage caused to the bodies, the time bodies have been left exposed, and its related changes and conditions.^[12]

Disaster Victim identification is an internationally recognised sequence established to be a definitive method by which the post-mortem material of the victim can be matched against the missing person data, to make a positive identification of the deceased victims.^[4] Individuals, who are properly trained are therefore directed to work as a team for identification process. All the action and operation taken by these teams should be interactive and well-coordinated. Disaster Victim identification guide formulated by Interpol, describes the basic principles and ensure that the DVI team implements the best execution to obtain efficient results in DVI operations.^[13]

DISASTER RESPONSE MANAGEMENT STRUCTURE

Any situation from the disaster field demands distinct operational units to carry out disaster response activities. A structurally organised and a properly functioning command team is to be implemented for effective coordination. DVI team, which is a part of overall disaster response, operates in conjunction with the other specialist services like emergency response, rescue and investigation units, under lead authority's organisational structure. (Fig 1) The lead authority is the one who assume the command of the operation as a whole and need to consider a broad range of significant issues, apart from rescuing survivors and minimising loss of life.^[4] In Indian scenario, the police department (investigating officer) take over the lead authority's responsibility for most of the operation, however, this may vary depending on the region and jurisdiction.

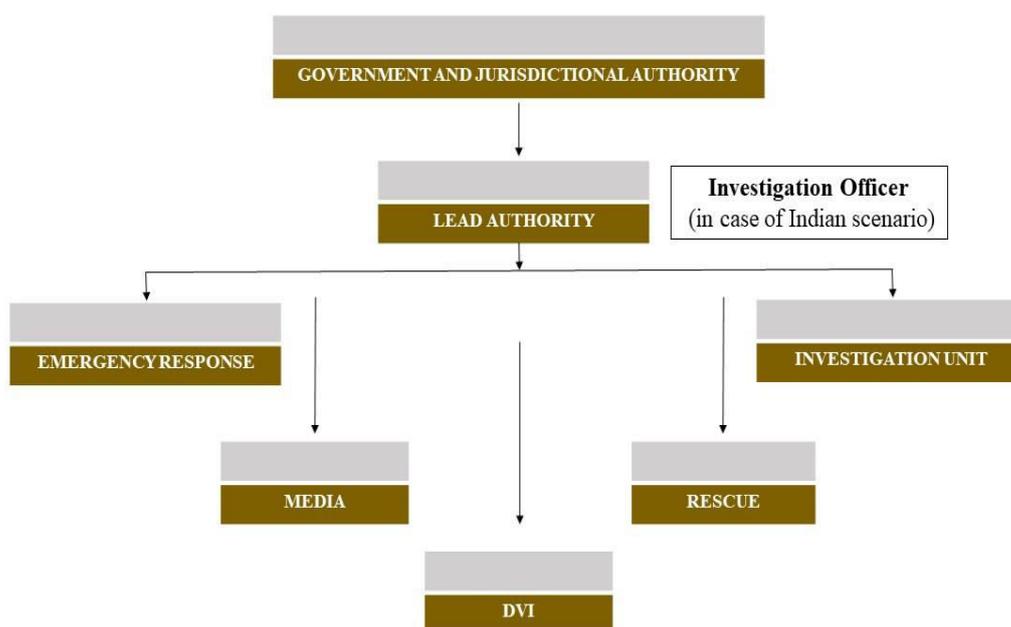


Fig. 1: Disaster Response Management Structure
Source: Interpol DVI Guide

Fig 1. Disaster Response Management Structure

DVI STRUCTURE AND POSITION OF FORENSIC ODONTOLOGIST

The DVI team is structured in such a manner that all the four phases are coordinated and monitored. (Fig.2) Reporting channels in each team ensure that all the information and directions are accurately communicated and interpreted. The DVI commander, with the support of various associated teams and trained specialists, assume a comprehensive responsibility to any DVI event. Among the various disciplines, Forensic Pathologists, Forensic Odontologists, Fingerprint experts, Forensic Biologists/Geneticists and Forensic Anthropologist are identified as the principal disciplines involved in the technical aspects of the DVI process. Forensic odontologist, one of the prime disciplines in identification, is positioned under the specialist section in all the four phases of DVI process. (Fig.2)

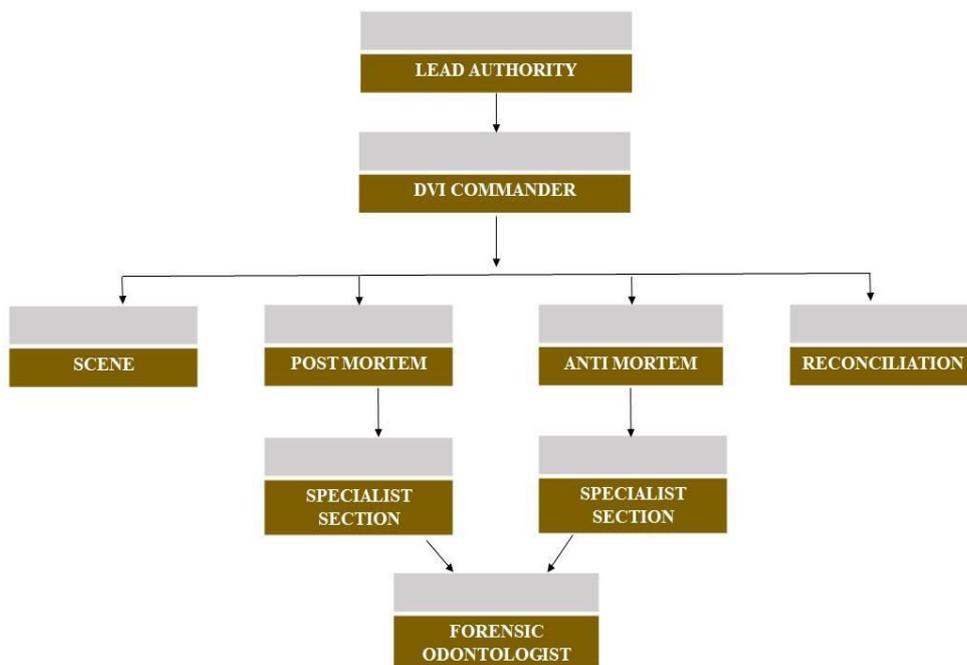


Fig.2 : DVI structure and position of Forensic Odontologist
Source: Interpol DVI Guide

Fig 2. DVI structure and position of Forensic Odontologist

VICTIM IDENTIFICATION AND THE CALL FOR FORENSIC ODONTOLOGIST

Victim identification methods used in mass disasters should be scientifically sound, reliable and applicable. Primary identification methods include friction ridge analysis, dental analysis and DNA analysis. Secondary identification methods include personal description (visual identification), medical findings, tattoos, property and clothing. These methods serve to support other means of identification and cannot be relied upon sufficiently as a solitary method. Due to subjective factors and stressful situations among relatives or friends, visual methodology is the least reliable in spotting victims. Finger print analysis is restricted to the availability of ante-mortem prints or retrievable latent prints from personal effects. In cases of severely traumatized and fire-associated mass disasters, there will be destruction of post-mortem finger print and foot print evidence.^[10]

Dental structures are highly resistant and preserved through many physically damaging events and can play an important role as remains for identification. Thorough comparison between ante-mortem and post-mortem dental records can then be made by forensic odontologists for evidence and reporting.^[14]

Generally, during victim identification, primary identification methods precede secondary identification. But, most of the Indian mass disaster cases employ secondary methods like visual and personal identification as a tool for identifying victims. (Fig.3) This reversal of the identification process leads to inappropriate and ineffective findings of victims. Forensic odontologists are invited on-site only when the need arises, which is usually after the failure of secondary identification methods.

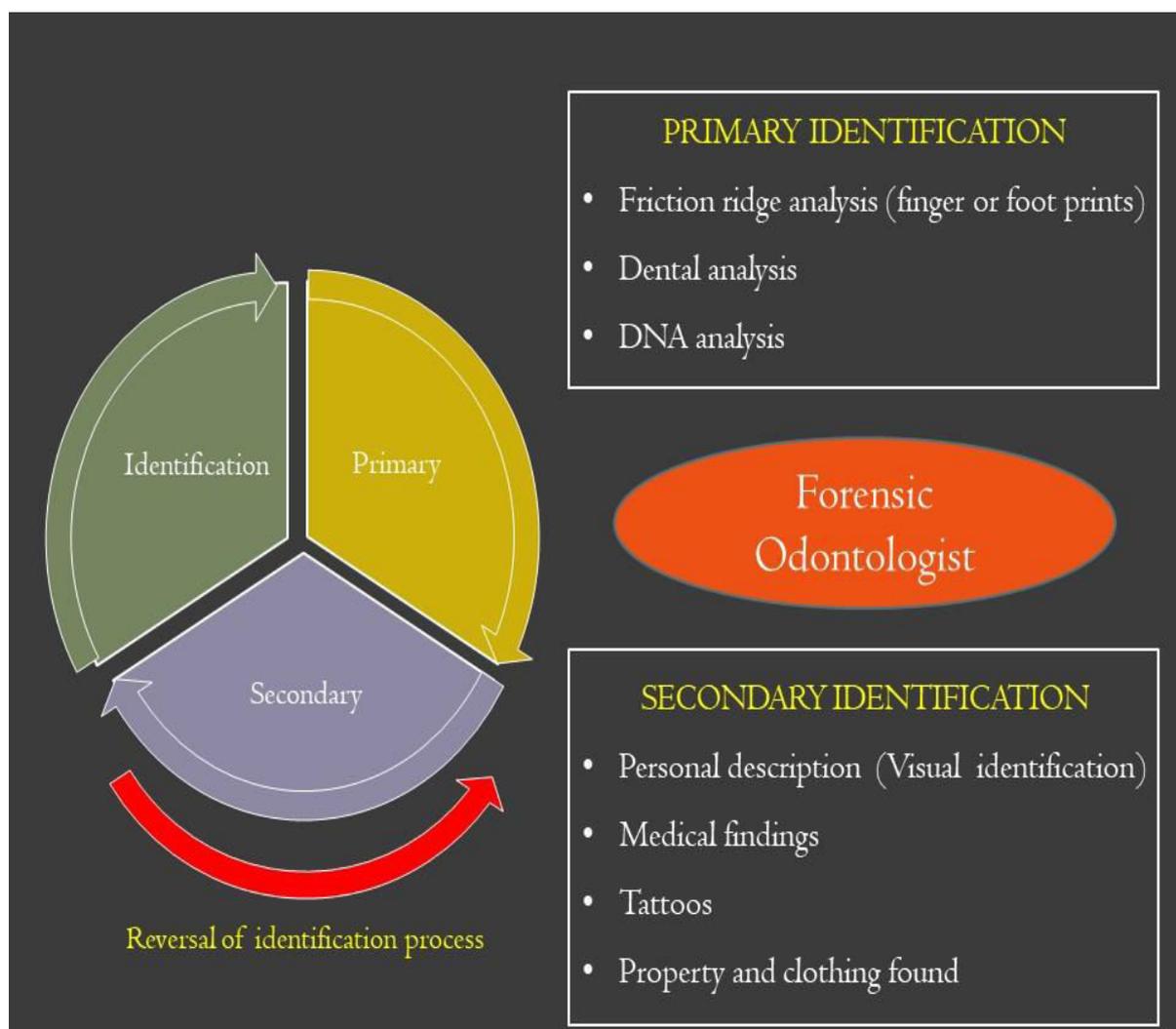


Fig 3. Reversal of Identification Process

ROLE OF FORENSIC ODONTOLOGIST AT THE SCENE

Dental team, once invited at the site of disaster, are involved in all the four phases of DVI such as scene, post-mortem, ante-mortem and reconciliation, to collect and systematically record all the data. The role of forensic odontologist is recommended to commence as a part of the recovery team which falls under the first phase of DVI, to consolidate or describe the dental evidence onsite, prior to its removal, to avoid any destruction of brittle dental substances (in case of charred bodies) during transportation to the mortuary.^[13] Odontologists should meticulously look out for any dislodged dental structures like implants, dentures and dental appliances at the site and a high resolution image of the same has to be taken for comparative analysis with ante-mortem data to ensure a clear reconciliation and debriefing procedure.^[15]

Post-Mortem Team

Human remains, which are transported from the disaster site, are stored in the temporary mortuary, set up for body storage and examination. A multifaceted team which involves forensic pathologists, odontologists, anthropologists, radiologists and photographers are involved in this phase. Dental examination of the remains will be carried out by a team consisting of forensic odontology examiner who assess the oral structures, and examine the dental status; forensic odontology recorder who prepares, records and completes the relevant

post-mortem data form and forensic odontology radiographic assistant who helps in preparing and developing the dental radiographs.^[4,15]

FDI nomenclature of numbering system is used for examining and recording the dental details. Age estimation of the remains is usually done by assessing dental structures and also by radiological methods. Photographs of the teeth, jaws and skull, and radiographs which include bitewing, periapical, occlusal and orthopantomogram are usually taken. All the data including photography and radiography should be in digital format and are uploaded in DVI software which may save considerable time and the risk of transposition error.^[4,13,15] DNA from bone and teeth are most stable even after putrefaction of bodies and isolation of the same from dental pulp serve as a vital tool in victim identification in severely mutilated bodies. This kind of genetic identification technique is also performed during this phase if required. The forensic odontology recorder records all these details in the post-mortem DVI form for further comparison with ante-mortem data is carried forth.

Ante-Mortem Team

The ante-mortem or the home team consist of experts who collect; records and processes information regarding the missing, injured and deceased persons. Information about the missing person, such as details of their health care providers is obtained from the family members/relatives. Medical/dental ante-mortem information is usually obtained by contacting the concerned physician/dentist.^[13] Dentists play a potential, significant and a supportive role in providing the maximum details of the person such as case sheet, x-rays, CT, photographs and models; and also communicate with the forensic odontologist for any further clarification, if the need arise. In addition to this, selective items like mouth-guards, dentures, tooth brushes and splints, used by the missing person are also collected, as this may serve as a tool for DNA extraction, which can be compared with the isolated DNA from the victim. All the collected ante-mortem records should be directed to the DVI centre for appropriate documentation and data entry.^[4,15]

Odontologist in the DVI team collects and transcribes all the information in the ante-mortem form, including the dates on which the information is obtained. Any poor quality record has to be clarified by the odontologist with the general dentist, who revealed the information of the victim. At the end of the phase, a quality control protocol is carried out to prevent discrepancies in the data input process.^[15]

Reconciliation

Comparison of both post-mortem and ante-mortem details along with the report of their closely similar matches are presented to the reconciliation board by team of experts in the phase of reconciliation. Forensic odontologist, compares these obtained records with both computerised and manual method and is accountable to explain minor discrepancies, if any. Positive identification of the deceased must be evidenced with every available data obtained by ante-mortem team including radiographs, photographs, models, and dental appliances. This clear, unbiased and standardised dental information are then filed and presented to the Identification Board (IB) by the forensic odontologist, followed by review, verification and approval.^[4,15]

LIMITATIONS AND RECOMMENDATIONS

Forensic odontology which is an integral part of victim identification in several countries is still in bud stage when it comes to Indian practice. Several literature reviews have been published in recent years portraying its limitations and recommendations.^[12,15-17] Issues such as lack of proper guidelines, lack of expertise and unavailability/improper maintenance of dental records seems to be unresolved.^[12] Various authors have also insisted the Natural

Disaster Management Authority (NDMA) to implement national level dental DVI team with qualified/experienced core group dentists, to perform victim identification.^[7,12] Multi-disciplinary policy as per the guidance given by INTERPOL DVI, 2018 need to be framed towards rescue, relief and rehabilitation. DVI operation with legally framed policies should be incorporated by the Government for ease of victim identification.^[18]

CONCLUSION

Although various detailed studies regarding the role of forensic odontologists have already been reported, knowledge of forensic odontology among the general dentists is likely to be minimal and the importance of the field has to be made known both for the academic as well as private dental practitioners. Self-questioning among the dentists like where they are located in DVI team, when they have been called and why there is a need of an odontologist in victim identification is very essential for the dentist to reply for any query arisen by the common person in the society. Conviction among the dentists regarding their significance in victim identification paves a path for confidence, when it comes to reality.

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