

# Disaster Victim Identification (DVI) through Dental Evidence: Overview and Challenges in Indian Scenario

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**Abstract:** A mass disaster is sudden and unexpected event that involves injury and death of large number of people. Every disaster is unique and involves interplay of different factors and circumstances such as: nature of disaster, number of victims, extent of body fragmentation etc that ultimately challenges the disaster response planning. Apart from the victim recovery and evacuation, the disaster response planning must include the established procedures for the identification of the victims of the disaster. The identification of victims essentially relies on forensic anthropology, odontology, fingerprints, radiology and DNA typing. This paper aims at discussing the role of forensic odontology in the Disaster Victim Identification (DVI), its status in India and some suggestions to develop the plans for same.

**Key words:** Mass Disaster, Forensic Odontology, Victim Identification etc

## I. INTRODUCTION

The United Nations Disaster Relief Organization (UNDRP) defines a disaster as: "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."<sup>1</sup> The term disaster can also be defined as "a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area."<sup>2</sup> The disasters can be classified in numerous ways depending upon their origin (manmade or natural i.e. the act of God), disasters related to extremes of weather like floods, droughts, cyclones etc. or extremes of earth geology like: earth quakes, volcanoes etc. or disasters of sudden occurrence (rapid onset) or may develop over the period of time (slow onset). India's geoclimatic location and the socio-economic conditions have made the country vulnerable to many types of disasters. The country is prone to disasters due to number of factors, both natural and human induced, including adverse topographic features, environmental degradation, population growth, urbanization, industrialization, flawed development

practices, etc. Out of 35 States and Union Territories in the country, 27 of them are disaster prone. Almost 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12 per cent of land) are prone to floods and river erosion; of the 7,516 km long coastline, close to 5,700 km, is prone to cyclones and tsunamis; 68 per cent of the cultivable area is vulnerable to drought.<sup>3</sup> The studies have shown that incidence of mass disasters is increasing around the world<sup>4</sup> and so is the number of victims died and affected. In India alone 59,072 deaths occurred from 1991- 2000 and the number of deaths increased to about 63611 in 2001-2010 due to various disasters.<sup>5</sup>

Some of the historical mass disasters events in India include: when at a school annual function at Mandi Dabwali in Haryana (1995) a tent caught fire killing more than 400 people, including children,<sup>6</sup> the super cyclone in Orissa in October, 1999,<sup>7</sup> the Bhuj earthquake, 2001,<sup>8</sup> Kumbakonam school tragedy 2004,<sup>9</sup> the Kashmir earthquake (also known as the Northern Pakistan earthquake or South Asia earthquake) of 2005,<sup>10</sup> and worst such disasters were at the 2004 Indian Ocean earthquake, known by the scientific community as the Tsunami disaster<sup>10</sup> and the Uttarakhand disaster or the Himalayan Tsunami<sup>11</sup>. All these incidents have urged the need to adopt multi disciplinary and multi sectoral approach not only in the disaster response planning but disaster victim identification also.

## II. IMPORTANCE OF DISASTER VICTIM IDENTIFICATION AND THE ROLE OF DENTAL ANALYSIS

Although every disaster is unique but they have one thing in common i.e. the large number of fatalities. The preservation of life is the top most priority at any major incident. So the disaster response teams mainly aim at rescue and care of the survivors and most of the disaster response plans don't cater the need of Disaster Victim Identification issue sufficiently.<sup>12</sup>

The term Disaster Victim Identification (DVI) refers to the task of establishing the identity of victims of a mass

disaster.<sup>13</sup> In the wake of recent disasters, now the DVI has emerged as a separate discipline. The proper identification of dead is not only important for humanitarian and emotional reasons for the next-of kin but also for legal and administrative purposes. Even the article 6 of the declaration on the Human Rights states that every person has the right to be recognized.<sup>14</sup> The identification is done primarily by parameters like visual acquaintance, fingerprints etc. but the use of such techniques may be limited in the conditions like mass disasters, burials etc. where the human remains are destroyed beyond recognition.<sup>15</sup> The situation may be further complicated due to number of factors like the number of fatalities, the scope of the population involved in the incident, the condition of the human remains (may be fragmented and distributed over a large area), the rate of recovery, the availability of ante mortem data.<sup>16,17</sup> In order for bodily features to qualify as scientific identifiers, they need to be unique, stable, and recorded ante- mortem.<sup>18</sup> Dental identification plays a key role in disasters especially in mass casualties associated with floods and earthquakes disasters, the situations that have also been highly recurrent in India in the last few decades. Following mass disaster, identification of individual victims by dental means is one of the most reliable methods identification in such situations.<sup>19</sup>

The use of dental records in identification is not new and it has been reported that Forensic Odontology was first used to identify victims of a fire in the Vienna Opera House in 1878.<sup>20,21,22</sup> The modern era of forensic odontology is said to have commenced with the identification of the victims of the Bazar de la Charité fire which occurred on May 4, 1897 in Rue Jean-Goujon, Paris. Many authors have reviewed the application of dental examination in various mass disaster situations like 9/11 World trade centre attacks, Hurricane Katrina, Tsunami in Indian Ocean etc. as an effective identification technique.<sup>15,23,24</sup> In order to use the dental data, the forensic odontologist analyze the dentition of the deceased individual for missing, decayed, filled, extracted and/or modified teeth and collect the post mortem data and compare them to the ante mortem records available with the dentists. Oral features are also assessed as they can be important in the identification of individuals that have not had extensive dental treatment<sup>25</sup>. Even those Individuals that have lost all of their teeth can potentially be identified based on the anatomy of the jaw bone or by dentures which may be distinguishable by shape, size, manufacturer and composition<sup>18</sup>. Apart from the identification, the information on the individual's age, race and sex can be determined from dental data.<sup>25</sup> Also, some of the dental anomalies like missing teeth, supernumerary teeth, presence of extra cusp etc. also form the important basis of identification of the individuals.<sup>26</sup>

The American Board of Forensic Odontologists<sup>27</sup> Body Identification guidelines recommend four conclusions when reporting dental identification (Table 1):

Table -1: ABFO Body Identification Guidelines

<b>Positive Identification</b>	<b>the ante-mortem and postmortem records match in details with no unexplainable discrepancies.</b>
<b>Possible identification</b>	<b>ante-mortem and postmortem data have consistent features but due to poor quality, identity cannot be positively established.</b>
<b>Insufficient Evidence</b>	<b>available information is insufficient to form basis for a conclusion.</b>
<b>Exclusion</b>	<b>the ante-mortem and post-mortem data are clearly inconsistent.</b>

### III. DNA IN DENTAL IDENTIFICATION

When conventional dental identification methods fail, biological material such as DNA may provide necessary link to establish identity. The revolution in DNA technology has expanded such that forensic DNA profiling has established itself as a gold standard for identification of unknown remains. The goal of DNA profiling for disaster victim identification is to extract as much genetic information as possible from highly compromised samples. The dental tissue is resistant to incineration, immersion, trauma, mutilation and decomposition so it represents an excellent reservoir of DNA.<sup>28</sup>

### IV. CHALLENGES IN INDIAN SCENARIO

Disaster Victim Identification is very challenging and demanding process. Unfortunately, like other developing countries, there is a great scarcity of any organized plans for identification of mass disaster fatalities in India.

India is far behind both in the theoretical and practical aspects of Disaster Victim Identification based on dental data. The Standard Operating Procedures are not available to guide and handle the Disaster Victim Identification Process. The consistent guidelines regarding ante mortem dental data collection are not available. The ante mortem records require the patient's oral and medical history and the treatment done but there is no uniform recording format followed throughout the country. The standard of dental care and frequency with which people visit the dentist varies around the country and while some people in urban population may have up-to-date records; this will not be the case for every area. Still there are many areas where population doesn't have access to basic medical facilities what to talk of dental treatments. Complete ante mortem dental records are most often lacking, so making comparative dental identification almost a mirage. If there is no ante-mortem dental information to which the post-mortem information can be compared, then the potential of

this technique to identify the individual accurately can't be utilized.

Further, there is no formal training or course in Forensic Odontology although it has been in news for quite some time that the Dental Council of India has approved a three-year Master of Dental Surgery (MDS) course in Forensic Odontology. But again the expertise and competency is a big challenge.<sup>29</sup> Also the Dental Council of India (DCI) has formulated regulations in which provision regarding teaching of Forensic Dentistry has been made in the final year of BDS (Bachelor of Dental Surgery) course.

Even in the routine Medico-Legal cases/Forensic Autopsy cases where examination of teeth is required, the cases are being handled by Forensic Physician and Forensic Pathologist and that too by the routine conventional methods.

#### V. THE UIDAI – THE GOVT. OF INDIA'S INITIATIVE TOWARDS IDENTITY

The Government of India undertook an effort to provide a clear identity to residents first in 1993, with the issue of photo identity cards by the Election Commission. Subsequently in 2003, the Government approved the Multipurpose National Identity Card (MNIC).

The Unique Identification Authority of India (UIDAI) was established in January 2009, as an attached office to the Planning Commission. The purpose of the UIDAI is to issue a unique identification number (UID) also called as Aadhaar to all Indian residents that is (a) robust enough to eliminate duplicate and fake identities, and (b) can be verified and authenticated in an easy, cost-effective way. Aadhaar is a 12 digit individual identification number which will serve as a proof of identity and address any where in India based on ten digit finger prints and retinal scan.<sup>30</sup> Although a robust system for the identification of living but cannot be applied in the cases of deceased with the severe disintegration and soft tissue destruction.

#### VI. DRAWING LESSONS FROM THE BEST GLOBAL PRACTICE

Many organizations like Interpol, France and National Institute of Justice, USA have proposed and formulated the standard operating procedures for the Disaster Victim Identification.<sup>31, 32</sup> Typically, DVI team comprises of different sections: body recovery and evidence collection team, ante mortem team, post mortem team, reconciliation team and identification board.<sup>32</sup>

There are various sophisticated computer software systems developed to do this including programs such as CAPMI, Plass Data (approved and used by Interpol), WinID and DAVID (used in Australia). The postmortem and ante

mortem data are entered into a computer database that will ultimately search for best possible matches.<sup>33, 34</sup>

USA has developed NDMS (National Disaster Medical System) which includes DMORT (Disaster Mortuary Operational Response Team). DMORT has effectively worked in the response to World Trade Centre attacks (2001), aftermaths of Hurricane Katrina and Rita (2005) to name a few.<sup>35</sup> Similarly DVI identification teams have identified large number of Victims of Indian Ocean Tsunami (2004), Bali Bombings (2002) and Christchurch Earth Quake (2011) using dental evidence.<sup>36, 37, 38</sup>

#### VII. RECOMMENDATIONS

Planning is crucial for successful identification of victims in mass disasters and a special identification team should be responsible for the work. The mass fatality response plan of India can be designed based on the international lines for Disaster Victim Identification. In India, a country that has witnessed several episodes of not only floods and earthquakes but a number of other disasters involving a large number of victims, the response to mass disaster is handled by the National Disaster Management Authority (NDMA).

Following suggestions can be kept by NDMA in mind for any pre-planning of disaster victim identification process since dental evidence is a powerful tool in the identification of dead.

It is the need of hour to establish a formally constituted Identification Commission as well as the consensus of Standard Operating Protocols in post -mortem evidence collection, preservation and analysis of Dental evidence and the most suitable identification technique based on the disaster situation.

A uniform National Dental Record Database can be maintained and made available to the appropriate authorities alternatively the protocols for collection of ante mortem data can be established to remove the discrepancies originating from the inaccurate data entry or translations from local languages.

Routine dental check up with appropriate radiography should come under primary care service in the National Health Schemes, this will afford reasonable generation of broad based national ante mortem Dental records for comparison at mass disaster instances

The development plan of Government of India /Ministry can incorporate the inclusion of Forensic Odontologist in the Disaster Victim Identification Teams.

The logistical requirements of the Disaster Victim Identification Process can be considered at the central level and proper memorandums can be established.

The technical knowledge needs to be effectively integrated with the scientific knowledge like use of different Victim Identification software: WinID and CAPMI etc.

Also in this era of globalization the issue of procuring the ante-mortem dental data from other countries needs to be addressed.

The National Institutes like University Grants Commission/Dental Council of India can take appropriate role in designing a specified curriculum and modules for education and training courses for Forensic Odontology or as part of Continuing Dental Education Programmes.

The basic vulnerability and epidemiologic data of the country can be used as a base in chalking out the response plan.

Drills/rehearsals can be planned periodically because failure to carry out exercises properly renders even the best plans useless. Training is an integral part of capacity building as trained personnel respond much better to different disasters.

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