



ROLE OF DENTISTS IN DISASTER MANAGEMENT: A REVIEW

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ABSTRACT

Dentistry has valuable assets, both in personnel and facilities, to bring to the initial response to a mass casualty event when the local traditional medical system is overwhelmed. Dentists are a large source of non-physician health manpower that could contribute to the public welfare during catastrophic events that require additional public health human resources. Ongoing vigilance by government, public health agencies and health care professionals monitoring potential manmade and ever-present natural disasters requires the continuous evolution of comprehensive disaster response plans and teams, which include the integration of oral health care professionals. Dentists, by virtue of their education, understand biomedical concepts and have patient care skills that can be directly applied during a catastrophic event. Dentists also can provide training for other types of health care workers and can supervise these individuals. This article reviews about the role of dentists in making significant contribution before, during, and after a catastrophic event or at the time of a public health emergency as part of a national response & focuses on mass disaster situations that may arise from natural or manmade circumstances and the significant role of forensic dental personnel in human identification following such occurrences. The education and training of dentists that is required for preparation and the need to develop an integrated emergency response plan are discussed.

INTRODUCTION

A "Disaster" as defined by World Health Organisation is "Any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area" [1]. The world has experienced a plethora of mass disasters in recent years: acts of terrorism, bombings, earthquakes, hurricanes, typhoons, air crashes and other transportation mishaps. These are disciplines for preparing, supporting, and rebuilding society when natural or manmade disasters occur. They are continuous process by which all individuals, groups and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from the hazards. The principal difficulties in mass disasters include large

numbers of humans fragmented, co-mingled, and burned remains, difficulty in determining who was involved in the disaster, acquisition of useful medical and dental records and radiographs for legal, jurisdictional, organisational, and political issues & internal and external documentation and communication problems [2].

Forensic dentistry plays a major role in victim identification. DNA and dental identification of human remains depends on sufficient availability of ante mortem information, existence of sufficient post mortem material and a comparison or match between ante and post mortem details. Forensic odontology is a specialty with a specific training, and cannot simply be carried out by dentists without such training [3]. Strategies for developing an international forensic odontology capacity and resources are needed for the management of dead bodies following a mass disaster, together with universal guidelines. Forensic odontology is the application of the art and science of



dentistry to resolve matters pertaining to the law. Some of the diverse facets of this unique discipline can range from the identification of human remains to mass disaster management, from the assessment of bite marks and patterned skin injuries to the use of dental materials in the examination of evidence. A dental record is the detailed document of the history of the illness, physical examination, diagnosis, treatment, and management of a patient. Dental professionals are compelled by law to produce and maintain adequate patient records. With the increasing awareness among the general public of legal issues surrounding healthcare, and with the worrying rise in malpractice cases, a thorough knowledge of dental record issues is essential for any practitioner [4].

The ability of clinical practitioners to produce and maintain accurate dental records is essential for good quality patient care as well as it being a legal obligation. The dental record provides for the continuity of care for the patient and is critical in the event of a malpractice insurance claim. Comprehensive and accurate records are a vital part of dental practice. Good record keeping is fundamental for good clinical practice and is an essential skill for practitioners [5]. The primary purpose of maintaining dental records is to deliver quality patient care and follow-up. Forensic dentistry can contribute to the identification of human remains after disasters or crimes, assisting other medical specialties. It must be mentioned that forensic medicine plays the role of the last counsel of defence, by helping to ascertain the circumstances of death. The contribution of dentistry to human identification takes two main forms: the identification of human remains according to dental records existing ante mortem, and a post-mortem dental profiling in cases where there are no ante mortem records. The ante mortem records are compared with the dental status of the cadaver giving strong evidence of the identity of the cadaver. In case there is no dental anamnesis, a thorough dental profile is being completed. This in turn helps the specialists to sort the existent ante mortem material and select the information that most fits to the profile of the cadaver. The importance of identification of human remains with methods of high accuracy is better understood in cases where the identification of the cadavers is impossible due to deformities caused by a disease that ailed the person and finally led to his/her death or by a natural or an aviation disaster [6].

Dental Identification

Keys for Dental Identification

Dental identification is based on the fact that teeth are morphological features like an ante mortem fracture or surgical intervention. That means that they are physical characteristics that endure throughout the decomposition process and are recognizable post mortem. Patients that underwent ante mortem dental treatment of special difficulty are often thoroughly registered, aiming at a better treatment planning and outcome. That means that dental x-

rays made for the diagnosis and treatment planning or study casts for the analysis of the articulation or a more or less complex prosthetic treatment plan provide information that can be compared with the cadaver's dental status. During this procedure the features that are compared are: presence or absence of teeth, the shape, size and bone peculiarities [7].

Tooth and Skeletal Characteristics in Age Determination

It is stated that special tooth characteristics like the Carabelli cusp are diagnostic markers for the racial categorization of the individual. In particular, the Carabelli cusp, formed by a folding of the inner enamel epithelium, seems to be greater in males than in females. Its formation is mostly related to large crowns and high cusps and a genetical predisposition may be present. Guo et al reported that the rate of the appearance of the Carabelli cusp is higher in the Japanese than in the Chinese population, thus this feature may be more characteristic in some populations. Skeletal characteristics visible on panoramic radiographs but mainly on lateral skull radiographs provide enough information when ante- and post-mortem films are compared [8]. In this manner, Kullman et al advocate that radiographs of the frontal sinuses can serve as a medium of identification. The process isn't influenced by the beam angulation or the experience of the observer. The characteristics to which the experts focus on are aplasia, symmetry, left or right asymmetry and the number of lobulations. Other morphological characteristics that are used as a marker for post-mortem identification are nutrient canals mainly of the mandibular alveolar process, visible on the post-mortem panoramic radiograph. Their number and location is compared with those on ante mortem radiographs [9].

Tooth Restorative Materials

In cases where the dental status cannot be evaluated due to a damage of the dentition of the victim, the recognition of the brand name of the used resin for restorative purposes may provide help in the collection of putative ante mortem dental records of the victim. Amalgam fillings may give important details. Bush et al mentioned the role of x-ray spectrum analysis of different resins in coupling each spectrum to a specific brand name. This is feasible due to the rarely altered inorganic composition of resins. The technique applied was SEM/EDS (scanning electron microscope/energy dispersive X-ray spectroscopy) [10]. In cases where the restorations were lost because of the circumstances of the death of the victim, these can be reconstructed with the use of amalgam/calcium hydroxide powder. The radiograph that is being obtained after this restoration can be compared with the putative ante mortem radiograph of the victim.

Previous dental restorations on incinerated teeth can be visualized with SEM analysis. This procedure can



reveal striations that are related to ante mortem dental restorations. These findings can be compared with putative ante mortem dental records of the victim [11].

Problems Occurring in the Identification Process

Edentulousness

Patients that do not have physical teeth anymore, represent a problem for the identification process of human remains. Even if there are ante mortem radiographs, there are morphological changes in the jaw bone due to the resorption of the alveolar ridges that render the identification difficult. Panoramic radiographs that exist ante mortem record can provide useful information only when the time space between the acquisition of the radiographs and the circumstances of the death of the victim is short. Without reference to the rate of absorption an intrinsic problem exists that may influence the ability to obtain post-mortem radiographs, that is the tomographic process. Lateral skull radiography is the solution in these cases, because of the reproductibility of the method. Goodman and Himmelberger presented a case of an unsolved homicide, where post-mortem casts of the victim were obtained for the acquisition of a cephalometric radiograph for the superimposition with putative ante mortem radiograph [12]. Palatal rugae impressions can also serve as a medium for identification in edentulous patients. Limson and Julian presented a computerized method of comparing details of ante mortem dental records and post-mortem details of the palatal rugae. It must be noted that the condition of the human remains is of high importance for the acquisition of impressions that can serve for human identification. That means that this approach cannot be followed in cases of skeletal remains. In order to ensure an easier identification process for edentulous victims it is suggested to introduce a denture marking system either with the form of a surface marker (engraving the casts, scribing the denture) or with an inclusion method (metallic labels, microchips). The typical partial denture may not give information regarding the victim if there is no inclusion method [13].

National Incident Management System (NIMS)

The NIMS is responsible for planning responses to catastrophic events that affect the health and well-being of large numbers of people and may encompass wide geographic areas. NIMS are to be used during any emergency event nationwide at the federal level through the Office of Emergency Preparedness and Federal Emergency Management Agency (OEP, FEMA). NIM was developed to provide an organizational structure that would allow responders from different jurisdictions and disciplines to effectively work together in catastrophic incidents. This multitiered level of response has been developed and continues to be adapted to prepare for the significant probability of both natural and manmade catastrophic events that may require multijurisdictional resources. NIMS can be activated to respond to chemical,

biological, radiological, nuclear, and explosive (CBRNE) threats, natural infectious epidemics, and weather and other natural disasters that can occur at any time and in any place with any intensity [14].

Disaster Mitigation

Emergency prevention and mitigation involves measures designed either to prevent hazards from causing emergency or to lessen the likely effects of emergencies.

Disaster Preparedness

Emergency preparedness is “A programme of long term developmental activities whose goals are to strengthen the overall capacity of a country to manage efficiently all types of emergency”. It should bring about an orderly transition relief from recovery and back to sustained development. The objectives of disaster preparedness is to ensure that appropriate systems, procedures and resources are in place to provide prompt effective assistance to victims, thus facilitating relief measures and rehabilitation of services [15].

How Dentists Can Help?

The prime purpose of recruiting the assistance of dentists in responding to mass casualty incidents is to enable crisis managers to use scarce physician resources in most effective manner possible by having some services they would ordinarily provide be successfully provided by dentists where possible. Local circumstances (i.e., the medical needs and resources of the community after a disaster and the nature of the disaster) determine how dentists can be of assistance. Some assigned duties do not tax the dentist’s knowledge or experience (e.g., dispensing medications or immunizations), whereas others may require additional training or some supervision (e.g., providing basic medical care in quarantine situation). There are several general areas of response activity in which dentists can help [16].

(1) Surveillance

Some mass casualty events are distinct entities easily recognized and of easily defined duration and effects on a population (e.g., a severe weather event). Other disaster, particularly bioterrorism attacks and pandemics, often have relatively indistinguishable beginnings and ends and unpredictable effects on a population. Because of the variable incubation periods of infectious agents, the time of exposure can be estimated only after the resultant disease has manifested. It also may take up valuable time to determine that population-wide problem actually exists. Dentists can be part of an effective surveillance network because they are scattered throughout a community [17]. Observation of intra oral or cutaneous lesions or both when they are present and the notification of public health authorities about these observations may facilitate the early detection of a bioterrorism attack or spread of a pandemic infection. Early detection of an infectious agent in a



population may allow for reduction in the number of casualties by prompt initiation of preventive and therapeutic intervention. Sales of over –the – counter medications are often monitored in the epidemiology community as a potential early warning of community – wide infections. Monitoring of unusual and unexplained “no show” patients in dental offices also may help provide an early warning. A reporting network and a real time analytics mechanism involving other inputs also must be established for this to be of value in early detection [18].

(2) Referral of Patients

Patients who show early signs or symptoms of infectious disease, have suspicious cutaneous lesions, or are suspected of having such disease may be referred to a physician for a definitive diagnosis and appropriate treatment, if necessary. This referral may be important because early treatment or early initiation of prophylaxis can have a significant influence on the outcome of the patient’s encounter with the disease. The clinical course of smallpox, for example, can be ameliorated by vaccination even after the patient has been infected [19].

(3) Diagnosis and monitoring

After an infectious disease that causes mass casualties has been identified, dentists who are able to recognize the sign & symptoms of that disease may help to identify afflicted patients. Dentists can collect salivary samples, nasal swabs, or other specimens when appropriate for laboratory processing that may yield valuable diagnostics information or indication of the progress of the treatment, including the status of the patients’ infectiousness [20].

(4) Triage

In the effective response to any mass casualty event a system must be established to prioritize treatment among casualties, because of immediate treatment for all casualties is not possible because of inadequate resources in personnel, facilities, and medical supplies. Dentists are able to assist in this important function with relatively little additional training. This assistance allows physicians to provide definitive care for patients most urgently in need rather than screening casualties. Dental offices could serve as triage centers if needed. Triage consists of rapidly classifying the injured on the basis of the severity of their injuries and their likelihood of their survival.

Red colour: It indicates high priority treatment or transfer.

Yellow colour: It signals medium priority

Green colour: It indicates ambulatory patients

Black colour: It is for dead or moribund patients [21].

(5) Immunization

To limit the spread of infectious agents, whether from a natural pandemic, a deliberate bioterrorism attack, or contamination as a result of a local event, rapid immunization of great numbers of individual may be

required in a short amount of time. In major metropolitan areas, where the spread of communicable disease is facilitated, this effort may involve millions of people. Physicians and nurses may be unable to implement such a program in critical time frame required. Dentists can participate in mass immunization programs with minimum of additional training and may be critical factor in the success of urgent programs. Dental offices can be used as immunization sites to minimize the concentration of potentially infected persons [22].

(6) Medications

In mass casualty situation, particularly after a bioterrorism attack or the unfolding of a pandemic infection, the population may require medication to treat or prevent the manifestation of the infection being faced. Physicians, nurses, and pharmacist may not be able to effectively prescribe or dispense the medication necessary in the critical, appropriate time required. Dentists can be called on to prescribe and dispense the medications required after that determination has been made by the physician and public health officials managing the disease outbreak. Dentist also can monitor patients for adverse reaction and side effects and refer patients who experience untoward effects from the medications to physicians for treatment, if necessary. Dentists also can be used as sources of information for patients concerning the medications they are using by communicating information and proper use, problems that may occur and their manifestation, and the need for compliance. Dentist can monitor the effectiveness of the treatment regimen [23].

(7) Infection control

Dentists and dental auxiliaries practice sound infection control procedures in their offices on a daily basis. They are well versed and well-practiced in infection control and can bring their expertise to mass casualty situations, particularly situations that involved infectious agents, to limit the spread of infection among Individual and between patients and responders who are rendering assistance. Decontamination casualties from certain bioterrorism attacks in which contact with patients’ clothing or skin surfaces may spread the agent to care givers may be accomplished by dentists with some additional training. Dentists who are familiar with disaster mortuary activities can be useful in managing the remains of victims whose death is a result of the event, particularly infectious events. These remains most likely will be contaminated and required careful management to prevent further disease spread [24].

(8) Definitive Treatment

In addition to providing services that dentists ordinary do, they may be able augment or participate in the treatment provided by medical and surgical personnel. Dentists have training and experienced in many areas that may be a part of casualty care in mass casualty events:



- Treating oral, facial, cranial injuries.
- Providing cardiopulmonary resuscitations.
- Obtaining medical histories.
- Collecting blood and other samples.
- Providing or assisting with anaesthesia.
- Starting intravenous lines.
- Suturing and performing appropriate surgery.
- Assisting in patient's stabilization.
- Assisting in shock management [25].

(9) Quarantine

During a pandemic or after bioterrorism attack with a communicable agent, strict quarantine restrictions may be imposed on the geographic area contaminated and its environs to help prevent can troll the spread of the disease to other areas. The duration of quarantine varies according to the incubation time of the agent and other factors. Before the existence of the area wide contamination is established, primary care providers may become infected directly or through contact with patients seeking care. During the period of quarantine they may become disabled by the disease or even die. Dentists may not be similarly infected by patients because ill patients do not seek care from dentists and, if sufficiently ill, do not keep a scheduled dental appointment, which minimizes intimate contact with infected persons. Dentist may call on to provide some primary health care for people in the quarantined area [26].

Are Dental Skills Applicable in Support of Mass Casualty Situations?

Barring casualties within its own ranks, the dental profession could be expected to supply reinforcement. With the exception of the medical and nursing groups, the dental profession is the largest group of professionally trained health workers. The physician, in a disaster is the pivot around which the whole effort revolves. In the event of his absence or of an insufficient number, who better can replace him than the dentist? No other profession has

undergraduate training that so closely parallels that of the physician as does the training of the dentist. The dentist has experience in the control of hemorrhage, the treatment of shock, the physical principle of debridement, the suturing of wounds and the reduction and immobilization of fractures. By virtue of his provided by dentists where possible. Local circumstances (i.e., the medical needs and resources of the community after a disaster and the nature of the disaster) determine how dentists can be of assistance. Some assigned duties do not tax the dentist's knowledge or experience (e.g., dispensing medications or immunizations), whereas others may require additional training or some supervision (e.g., providing basic medical care in quarantine situation).there are several general areas of response activity in which dentists can helpful [27].

CONCLUSION

The competence to cope with the intra-disciplinary emergencies that might arise in a national disaster can be acquired in dental schools either as part of the undergraduate curriculum or as postgraduate studies. The competence to cope with extra-disciplinary emergencies, however, cannot be achieved by dentists without the effective support and guidance of other professions. With such help a nucleus of dentists can be trained in the principles of medical, hospital and public health practices; these in turn, with the help of dentists specialized in various fields, can extend the training to dental undergraduates and dental practitioners. By doing so, dentists can help humanity and making world a better place to live in. It is vital that a person interested in forensic odontology be properly educated and trained. There is an urgent need to organize workshops at different cities to highlight the practical aspects of forensic odontology in routine practice. It may also be added as a continuing medical education in the subject for existing practitioners, at different dental colleges throughout India, to strengthen the knowledge, remove the self-held misbelieves, and highlight the practical uses of forensic odontology.

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