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.

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. 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.

Fields and Molina in 2008 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 fingerprint pad, 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 fingerprint pad to retract the fingerprint pad by cutting the underlying tissue with a pair of scissors. The fingerprint 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 fingerprint 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 fingerprint from the mummified bodies.

**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. Even aortic tissues can be used for non destructive extraction of DNA which is a much easier than bone or tooth.

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).

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. 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.

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.

**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, degenerative processes, and articural surfaces and taking accurate measurements.  

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. 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. The limitation of this method is compulsory availability of ante mortem records for matching.

Skeletal Observations
Physical anthropologists can estimate the stature by direct measurement from non-fleshed human remains or by using radiological methods. CT scan can provide highly accurate measurem ents. Determination of sex can be 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. 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. 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. Similarly in 2016, Agrawal et al., identified two mummified bodies from an avalanche in Nepal by dental means.