

# The Application and Cogency of Dental Restorations and Endodontics in Forensic Odontology

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## ABSTRACT

Dentition, its number, alignment, shape, size, morphology, and its relation to various adjoining structures in the jaw provide uniqueness to every individual. Dental restorations and endodontic treatment in one or more teeth in an individual can provide further distinctiveness which cannot be matched with another person. This editorial presents the application and validity of dental restorations in the human identification and deliverance of justice. This editorial also presents the current status of forensic odontology in India and other countries and how the possibilities of this science and art can be further disseminated for the benefit of the society.

**Keywords:** Dental restoration, Endodontic anatomy, Forensic dentistry.

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Human identification is one of the major fields of study in forensic sciences. In this sphere of forensics, dental identification is one of the most reliable and frequently applied methods of human identification, and hence, forensic odontology has developed as a speciality in itself. The fact that teeth are immune to assault makes it the most feasible anatomical structure for human identification. With natural and anthropogenic mass catastrophe such as tsunami, earth quake, landslides, flood, air, rail, road and sea accidents, infernos, mass murders, and terrorism on the increase, forensic odontology not only finds its way for individual identification but also for mass fatalities. It also has a cultural and ritualistic significance as the dignity of the dead is a great concern for the relatives who have lost their near ones.

History has documented a number of cases where dental identification was paramount and successful particularly for identifying the unidentifiable by other means. As early as 1191, the mortal remains of Raja Jayachandra Rathore of Canouj on the battlefield was recognized by his false anterior teeth; one of the earliest cases of dental forensics in India. In 1897, an article entitled, "The role of a dentist in the identification of the victim of the catastrophe of Bazar de la Charité, Paris," was presented by Dr Oscar Amoedo a Professor at the dental school in Paris, at the international medical congress of Moscow. The Bazar at which the wealthy women of Paris annually raised money for projects for the poor was destroyed in a fire. One-hundred and twenty-six people lost their lives in this fire. Thirty corpses in this were identified with dental identification when other methods were unsuccessful. Though there are a number of anecdotal incidences of human identification using dental evidences before this incidence, this presentation probably was one of the earliest to initiate the inclusion and involvement of dentists in human identification. There are many such reported incidences where dental evidences have helped in the identification of victims in mass disasters. To cite another one, in the Lockerbie air disaster in 1988, out of the 253 bodies identified, about 209 were identified with dental evidences. Similarly, there are records of many incidences where dentistry has played an important role in the identification of victims and perpetrators in crime.

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The dental restorations and endodontics can contribute immensely to the identification process. The shape of the restorations, obturated pulp space, and the composition of the materials used provide a wealth of information that can enormously contribute to dental forensics. According to the American Dental Association's, Council on Dental Materials, Instruments and Equipment, radiopacity is one of the five basic requirements any restorative material must fulfill. All radiopaque materials allow for easy distinguishing of dental work, aid in evaluation, and comparison of internal contours, including defects such as deficiencies, overhangs, overfills, and major voids.

The effect of heat, environment, and time on common restorative and endodontic materials such as resin composites, cements, ceramics, and metal alloys used in dentistry is periodically documented in various literatures. These particularly with the qualities and quantities of traces provide abundant information for the identification of disaster victims. Many techniques have been explored to identify the materials with noninvasive techniques as well as using minimal quantity of materials harvested from the restoration or the tooth which was bearing the restoration.

The dental pulp contains the victim's DNA which can be extracted from the victim's pulp chamber for identification. The amelogenin gene extracted from dental pulp is used for identification of victim's gender. The enamel rod prints are as unique

as finger prints, and they are resilient to any form of destruction. A DNA bank preserving the pulp extirpated by endodontists in the future may not be a surprise to the dental fraternity.

With the advancement of technology many current and long existing instruments can be utilized for forensic dental identification by the specialists in conservative dentistry and endodontics. The use of digital impressions, digital photography, unwrapped computed tomography, cone-beam computed tomography, X-ray fluorescence, scanning electron microscopy/energy dispersive spectroscopy, ultraviolet photography, infrared photography, optical coherence tomography, *in situ* (intraoral) microsampling technique, etc., have been investigated and found useful.

Forensics relies a lot on the ingenuity of the individual specialist. Fundamental principles based on physics, chemistry, and biology govern the criminalistics and human identification using appropriate instruments and instrumentations. The forensic science laboratory in the different states in India is worth a visit for all dental surgeons interested in forensic dentistry. The amount of work that can be done, the novelty that can be incorporated, and the intellectual resources available in these laboratories are significant. Commonly available instruments and equipment in these laboratories include those used to assess physical properties such as enhanced visual appearance; nonoptical properties like hardness and density; general optical properties like refractive index and dispersion; optical properties such as interaction with electromagnetic radiation like opaqueness, translucence, and reflectance; optical properties with absorption spectra of electromagnetic radiations; and optical properties with emission of electromagnetic radiation like photoluminescence, fluorescence, UVF, IRL, and phosphorescence. Similarly, devices for various chemical analysis and separation of biological substances like proteins, enzymes, and hormones such as those used to analyze percentage composition of elements, trace elements, solubility, and chromatographic and electrophoretic separation including facility for polymerase chain reaction and DNA analysis are available in many laboratories.

Forensic odontology independently as well as with forensic medicine has helped in the disaster victim identifications as well as crime investigations. The Indian Law of Evidence regards biological forensic evidence as one of the most crucial investigative leads. The various disciplines within the science of dentistry have contributed to this. Dental restorations, their types, the teeth restored, the different materials with which the different teeth are restored, the surfaces involved in the restorations, the radiographic images of the outline of dental restorations, all contribute to uniqueness and hence a positive identification. Similarly, endodontic treatment rendered, the teeth treated, and radiographic appearance of the

pulp space obturations contributes immensely to exclusivity and a positive identification. There are a number of case reports where restorations and endodontics have aided in the identification of unknown bodies. A number of concordance points can be figured from restorations and endodontics. Even one unique concordance may be enough to confirm an identity, i.e., the value of forensic odontology with respect to conservative dentistry and endodontics. The courts are hence utilizing the opinion of dental experts in the deliverance of justice in India and most parts of the world.

The significance of evidences that can be harvested from our speciality should be made known better to the people concerned like the police, judiciary, and the forensic medicine specialists. This is possible only by more work to be done in the field of forensics from within the speciality of conservative dentistry and endodontics. The outcome of such work should also be published in reputed journals so that they form valuable references. Only such reference will form convincing evidence and help in the utilization of the science in the deliverance of justice.

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