

Identification through dental age estimation in skeletal remains of a child

Neeta Sharma,
Sangeet Dhillon¹
*Department of Oral
Medicine and Radiology,
H.P.G.D.C., ¹Department
of Forensic Medicine and
Toxicology, I.G.M.C., Shimla,
Himachal Pradesh, India*

Address for correspondence:
*Dr. Neeta Sharma,
A-499, Sector 4,
New Shimla, Shimla - 171 009,
Himachal Pradesh, India.
E-mail: docneetasharma@gmail.
com*

Abstract

The analysis of skeletal remains opens the portal of scientific truth that enables the justice system to discover the facts and circumstances surrounding criminal acts. There is definite role of forensic odontology in identification and determination of dental age of skeletal remains (mandible), especially when visual identification and fingerprints cannot be used. Here, we present a case of a missing boy whose skeletal remains were recovered from a water tank. Skeleton remains were brought by police personal with an alleged history that the remains belong to a child who has been missing since 2 years. The skeletal bones after anthropological study, forensic odontology findings and DNA profiling, were confirmed to be of the missing child's. A skeletonized body recovered from water is not capable of being identified by visual means, and hence, other examinations i.e., forensic odontology and DNA profiling, substantiate the case.

Key words: Dental age estimation, forensic odontology, medicolegal case, Shimla, skeletal remains

Introduction

Dental identification of the human occurs for a number of different reasons and in number of different situations. The forensic identification of human remains is a legal determination based on the scientific matching of information on missing person with unidentified human remains. Persons who have been deceased for some time before discovery and those found in water also present difficult visual identification.^[1] The identity of the human remains can be established by the following means:^[2]

1. Personal recognition by relatives and friends (visual)
2. Finger prints
3. Dental examination
4. Medical examination
5. Skeletal examination
6. Radiological examination
7. Serological examination
8. DNA examination.

Case Report

A young boy aged 4 years, resident of Shimla was reported missing in 2014 and a case was registered in Police Station the same day. Later on, three accused were nabbed by the CID in August 2016 and they confessed the kidnapping and murder of the young boy. Accused who were his neighbor lured the boy with chocolates and forced him to consume liquor, and when he lost consciousness, they kidnapped and he was kept in a rented house. Unable to get ransom, accused dumped the alive unconscious boy in the municipal water storage tank, using some stone tied with a small rope to his feet. Accused confessed the crime and helped Police and State Forensic Science Laboratory (SFSL) to recover skeletal remains and mobile SIM of the accused from the water tank. Bones were sent to the Forensic Department.

The skeletonized mandible [Figure 1] was sent to our department from the Forensic Medicine Department for age estimation and any

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other contributory finding. The mandible along with few other bones was recovered from the water storage tank. Other bones were two parietal bones, a part of occipital bone, intact mandible with a few teeth, a portion of rib present (articulated part), Intact ribs, part of right scapula, part of right zygomatic bone, eight vertebral bones, meta carpels and pharyngeal bones (15 in number), left ulna bones, right femur, six foot bones (meta tarsals), a small portion of the palate bone, and two fibulas (left and right). Skeletal bones were examined and the following inferences were drawn. The anatomical features of the mandible and the morphology of the attached teeth were consistent with features of those of a young human. Bones were wet in appearance. No blood clots were present. Race could not be determined as the skull bones were not complete. Sex could not be determined as age of bones being less than puberty. No sharp cuts and no identification feature were present on the bone.

Osteometry and dentition status of the mandible

Bi-condylar length = 8.5 cm. Bigonial length = 6.9 cm. Mental foramen-Alveolar crest length = 1.3 cm. Mid-symphysis length = 2.3 cm. Gonial angle = 135°. The mandible was intact with right and left deciduous molars in the socket, and the empty sockets of deciduous incisors and canines were present. Due to degraded left lingual cortical plate, crown of unerupted first permanent molar was visible. As the permanent mandibular first molar was unerupted, the dental age seemed to be below 6 years. Orthopantomogram was taken; however, due to very low density of the specimen, the image was not diagnostic. Anterior and left and right posterior segment of the mandible were radiographed on occlusal film on Dental X-Ray unit 60 Kvp 7 mA (CS 2100). Radiographic findings revealed crypts of permanent teeth in different developmental stages [Figures 2-4]. The dental age was estimated by using Demirjian's method.

Demirjian's method (7-teeth method)^[3]

- If girl, age = 5.1 years (mean absolute error = 1.29 years)
- If boy, age = 5.7 years (mean absolute error = 0.94 years).

There were no antemortem dental records of the missing boy. The mandible was sent back to the Forensic Medicine Department, and all bones were later sent to SFSL for DNA profiling and Diatom Test by the Forensic Medicine Department. Diatoms were detected in the femur bone and were comparable with diatoms detected in the sample of water taken from the tank (The water storage tank does not supply the deceased house). The results about age at death and sex were compatible with biological profile of the missing boy when the DNA of the skeletal bones revealed of a male which matched to the missing boy's parents' DNA. The kidnappers were sentenced to death by the District and Sessions Court under section 302, 347, and 201 of the Indian Penal Code.

Discussion

Skeletalization is a consequence of the post mortem changes of the deceased body, and it depends on the circumstances under which it has been found. Under temperate conditions, the minimal time taken for complete skeletalization is about 12–18 months.^[4] The timeline of skeletalization is minimal when the body lies in the



Figure 1: Mandible



Figure 2: Right half of the mandible radiographed on occlusal X-ray film showing permanent tooth crypts in developmental stages



Figure 3: Left half of the mandible radiographed on occlusal X-ray film showing permanent tooth crypts in developmental stages

open, hot, and humid environment. This is because of the increased microbial and insects activity. Furthermore, the chance of getting intact skeletal remains in the open environment is less because of scavenging of the body by the predators. However, in a closed or concealed area, like the one encountered in this case, there is much chance of having entire skeleton. However, the remains of infants and juveniles are a greater challenge as the bones are not only smaller but also have different forms than the adult bones.^[5]



Figure 4: Anterior mandible radiographed on occlusal X-ray film showing permanent tooth crypts in developmental stages

The main query addressed by the forensic experts in case of skeletal remains are:^[6]

1. Is it human remains?
2. What bones are present?
3. Is there more than one person present?
4. What is the sex and age of the person?
5. What is the stature of the person?
6. What is the race or ethnic origin of the person?
7. Are there any individual characteristics present in the remains?

The forensic odontologists are mainly concerned with the estimation of the age and determination of the sex of the individual based on the odontological characteristics. These evaluations can narrow down the search of the individuals and thus aid in the possibility of positive identification of the deceased.

The dental age estimation involves several visual/morphological, radiological, and histological methods.^[7,8] The application of dental age estimation methods depends on the type of case and the biological nature of the specimens sent to odontologists. In the present case, only the dentate mandible was provided with the request for estimation of age. The visual or the clinical method was applied, and the dentition status of the mandible was noted. The mandible had teeth whose morphological features were consistent with the features of the teeth of the primary dentition. The permanent first molar on both sides have not attained the occlusal height of the deciduous molars. The radiological findings also revealed the other teeth of the permanent dentition in varied degree of developmental stages. The most commonly used age estimation method of Demirjian *et al.* was applied to estimate dental age.^[3] As sex of the individual was not known, the age estimation formula for both genders was reported. The empty sockets of the canine and incisors in the mandible suggest that the postmortem loss of the teeth or might have avulsed or lost during period of captivity, possibly due to physical abuse to the child by perpetrators (antemortem or perimortem loss). The deciduous molars were intact and virgin, thus nullifying the chance of an antemortem dental record. The forensic odontology investigation in this case gave a threshold that the deceased person is a child below the age of 6 years. This was consistent with the confession given

by the accused, who claimed to have abducted a child of 4 years. Although the confirmation of the identification of the child was done through DNA investigations, the forensic odontology part was crucial for estimating the age of the deceased child.

In our case, the radiography of the dry mandible was difficult with the conventional panoramic machine. We tried the suggested method given in the literature such as adding previously exposed film in the cassette and placing paper and acrylic pads in the path of X-rays.^[9] Proper result could not be obtained as over exposure was present due to the absence of soft tissue and vertebrae at the lowest setting of the panoramic unit. We achieved a diagnostic image by taking radiograph of the right and left posterior and anterior segments of the mandible on the occlusal X-ray film.

The cause of death in the present case was evaluated based on the presence of diatom in femur bone and in the water medium.^[10] Thus, it was a case of antemortem drowning of homicidal manner.

Conclusion

The identification of individuals missing for prolonged periods can bring sorrowful relief to family members. The DNA of the skeletal bones matched with the missing boy's parents. A skeletonized body recovered from water is not capable of being identified by visual means and hence other examinations, i.e., forensic dental examination, to estimate dental age as it narrows down the search window and DNA profiling substantiates the case.

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Conflicts of interest

There are no conflicts of interest.

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