Effectiveness of the Al Qahtani method in estimating gestational age in the context of an alleged illegal abortion: a case report

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Case Report

Effectiveness of the Al Qahtani method in estimating gestational age in the context of an alleged illegal abortion : a case report

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ABSTRACT

Introduction: Age estimation is crucial in forensic and dental sciences, particularly for determining gestational age in suspected illegal abortion cases. This study highlights the significance of the Al Qahtani method, which focuses on dental development, as a reliable approach for estimating gestational age. Gestational age is commonly assessed through body length, weight, and the maturation of skeletal and dental structures, with radiographs serving as essential tools for evaluating dental development. The aim of this case report is to demonstrate the effectiveness of the Al Qahtani method in estimating gestational age in the context of an alleged illegal abortion. **Case report**: The body of an unidentified infant was found on the side of the road, wrapped in a piece of white cloth and a brown sarung. It was transported to the hospital's forensic department for identification. Periapical radiographs were taken of the anterior areas of the teeth, and the Al Qahtani method was employed to determine the age of the deceased infant. The radiographs provided a clear overview of dental maturation, which was essential for accurate age estimation. **Conclusion**: The Al Qahtani method is recommended as a standard practice in forensic odontology for estimating gestational age in abortion cases. This method contributes significantly to medical treatment, criminal investigations, and legal proceedings, enhancing the accuracy of age determination and supporting both medical and legal contexts.

KEYWORDS

Age determination, gestational age, dental radiography

INTRODUCTION

Forensic age estimation is essential in cases where chronological age is unknown due to missing records or suspected identity fraud. It plays a critical role in legal and investigative contexts, using methods such as dental and skeletal analysis, DNA methylation, and medical imaging to provide accurate age estimates. These

findings are crucial for resolving disputes in legal culpability, asylum claims, and identity verification, emphasizing the importance of reliable and scientifically validated techniques.

Additionally, forensic age estimation is key in cases involving criminal offenses, such as penalties for abortion of an abandoned infant, where determining the age of the fetus or infant can be pivotal in legal proceedings. Forensic examination to estimate the age of the deceased refers to the application of scientific methods and techniques such as physical assessments based on anthropometric measurements, skeletal maturation analysis, dental age estimation, a combination of dental development with anthropometric measurements, and a combined evaluation of skeletal and tooth eruption.[1] These methods are employed to accurately predict the age of an individual accurately when their true identity is uncertain. Age represents a stage in a person's life, measured in years from birth, typically characterized by a specific level of mental or physical development, and often associated with legal responsibilities and capacities.[2]

Dental records are widely utilized in forensic identification. Forensic odontology plays an important role in identifying unknown corpses. Forensic odontological examinations are the primary means of identification in decomposed corpses that have occurred as a result of explosions, fires and other disasters. The formation and growth of tooth germs in fetuses is of great significance in various fields, including pediatric dentistry, anatomy, biological anthropology, and forensic dentistry. In forensic dentistry, in particular, it plays a key role in identifying unidentified human remains and estimating age. Gestational age estimation takes into account factors like body length, weight, as well as skeletal and dental development and maturation.[3]

Dental development charts are commonly used to assess tooth growth and maturation by analyzing the developmental stages. Notable among these are the charts created by Schour and Massler, Ubelaker, and Al Qahtani, which are widely acknowledged for assessing dentition stages.[3–5] Research by Helen has d that Schour and Massler's chart is the preferred reference for early childhood development.[6] However, there is limited research on the growth and development of tooth germs specifically in fetuses.

The Al Qahtani method is the most recent approach to complement existing methods. It has comprehensive criteria, is evidence-based, and is recognized for its accuracy, sensitivity, and ease of use. Al Qahtani's research was conducted in London using white and Bangladeshi populations living in Europe, although race is one of the factors that affect tooth growth and development.[7–9] Racial differences lead to differences in the timing of calcification and eruption of permanent teeth. Radiographs enable the visualization of tooth eruption stages during growth and development, allowing for the determination of a person's dental age. The methods for age assessment are fairly straightforward, involving the identification of mineralization stages in radiographic images, which are then compared to standardized stages to estimate an approximate age range.[10]

Radiological analysis provides crucial information in forensic dentistry and is regarded as conclusive evidence in legal proceedings and case identifications. Due to its widespread use in documenting and evaluating findings, radiology is endorsed by the United Nations, Interpol, and the American Board of Forensic Odontology for application in mass disaster investigations and victim identification.[11] The Al Qahtani age estimation technique was developed by Al Qahtani in 2008.

This technique involves comparing radiographic images with an atlas detailing the calcification and eruption stages of teeth, created by Al Qahtani. The method evaluates both deciduous and permanent teeth in the right maxillary and mandibular regions, based on their calcification process, root resorption, and eruption. The Al Qahtani Atlas covers an age range from 28 weeks of intrauterine life to 23 years. At certain ages, there are symbols that indicate the deviation from the estimated age.[11–13] This article has obtained permission from the ethical

committee of FKG UI with number 20/KEPKG/FKGUI/VIII/2024. The aim of this case report is to demonstrate the effectiveness of the Al Qahtani method in estimating gestational age in the context of an alleged illegal abortion.

The novelty of this research is the application of the Al Qahtani method for estimating gestational age in cases of alleged illegal abortion. While the method has been widely used for age estimation in forensic and legal contexts, its use in determining gestational age broadens its scope of application. By utilizing radiographic analysis of tooth calcification and eruption stages, this research demonstrates a new forensic approach to assessing fetal development, providing a more precise and evidence-based technique for legal investigations

Case Report

The body of the unidentified infant was found on the side of the road, covered with a piece of white cloth and brown sarung. It was taken to the hospital's forensic department for identification.

The corpse was found without jewelry or clothing, except for one nearby object: a black plastic bag. Upon opening the bag, the following items were discovered: one pair of wet black cotton trousers branded "EPRISE," size "M"; one wet red cotton headscarf adorned with red beads; one unbranded purple t-shirt with no size indicated; and an opened 38-gram packet of "Rinso Anti Stain" detergent

The extraoral examination revealed a 6 × 3 cm purplish-red area extending from 3 cm to the right of the frontal midline, across the nose and lips, to the left cheek, 3 cm from the midline and 2 cm from the lateral canthus. The upper and lower eyelids of the right eye showed a 2.5 × 1.5 cm purple-black discoloration, and the left cheek, 5 cm from the midline and 3 cm below the lateral canthus, had a 3.5 × 2 cm purplish-red area. No fractures were visible or palpable (Figure 1).

Intraoral examination showed that the gum pads had no erupted teeth in either the maxilla or the mandible. In the maxillary view (A), only the gum pads are visible, with no signs of dental eruption or abnormalities. Similarly, the mandibular view (B) shows the absence of erupted teeth, with only the gum pads present. These findings confirmed that the deceased's oral cavity consists solely of gum pads in both the upper and lower arches (Figure 2). Periapical radiographs were taken of the anterior areas of the teeth, focusing on the developing dental structures. These radiographs provided detailed images that revealed the stages of tooth development and eruption, which serve as critical indicators of gestational age (Figure 3). In this case, dental age estimation was performed by comparing the radiographs with the Al Qahtani atlas, determining that the deceased male infant age was 34 weeks in utero, with a range of 1 month (7.5 to 9.5 months intra uteri) (Figure 4).

By utilizing the Al Qahtani method, a well-established approach in forensic odontology, the age of the deceased infant was determined based on the observed dental maturation. This method relies on specific developmental milestones in the formation of primary teeth, allowing for a precise age estimation. The clarity of the radiographs enabled a thorough assessment of the dental maturation process, ensuring accurate results. In this case, the radiographs not only facilitated the identification of dental stages but also provided valuable information regarding the overall gestational age, which is essential for understanding the circumstances surrounding the case.

Figure. 1. Overview of the entire body of the deceased; A. superior view; B. lateral view

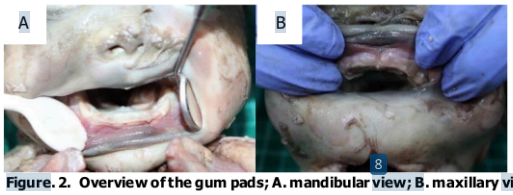


Figure. 2. Overview of the gum pads; A. mandibular view; B. maxillary view

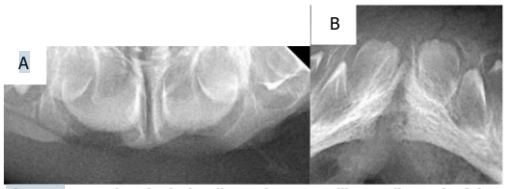
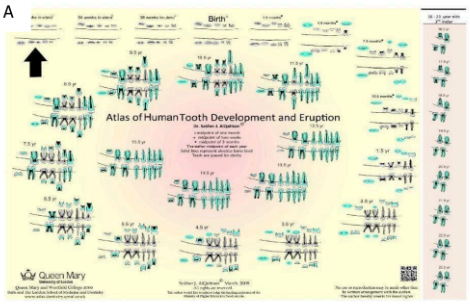


Figure.3. Dental periapical radiographs; A. maxillary radiograph of the anterior tooth buds; B. anterior mandibular tooth buds' radiograph



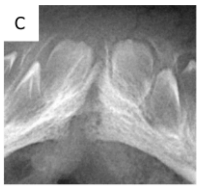


Figure.4. The london atlas; A. atlas of human tooth development and eruption by al qahtani; B. the stage of the deceased infant's tooth development according to alqahtani's London atlas; C. Radiograph of the infant

DISCUSSION

Dental development is the most reliable indicator compared to the previously mentioned indicators such as physical assessments based on anthropometric measurements and skeletal maturation analysis, in determining a person's chronological age because dental development is very stable and is only slightly influenced by environmental factors, socioeconomic status, nutrition, commonly consumed food, and endocrine influences. [9] There are many methods used in this regard, but each has its own shortcomings. Scientists continue to research, modify and review existing methods. A common issue is the lack of clear evidence behind the age determination techniques that have been created, along with small research samples, and narrow age ranges.[14]

In cases of mass disasters or criminal investigations, dental records and radiographs are valuable for estimating age based on tooth development or other characteristics. However, research on tooth bud growth and development during gestation is limited due to the difficulty in obtaining gestational specimens. The formation and eruption of tooth germs in fetuses can aid in estimating body length, weight, skeletal and dental development. Dental development charts are commonly used for estimating dental age, with the well-known charts from Schour and Massler, Ubelaker, and the London Atlas frequently employed to assess stages of dentition. [15–17]

In terms of dental age estimation accuracy, the London Atlas chart has been found to be more precise compared to those of Schour and Massler and Ubelaker. Recent studies have also indicated that tooth calcification is associated with estimating gestational age.[7] However, tooth eruption or gingival emergence represents only one stage in the continuous whole process of dental development and maturity.[18]

The periapical radiograph provides a more detailed anatomical view compared to panoramic radiographs. This is primarily due to the focused nature of periapical images, which capture a specific area of interest more clearly. [19,20]

The development and eruption of teeth are useful dental events to assess age.[21] The tooth development process starts with the initiation of tooth bud formation from the embryonic cells and continues until complete root development.[22] Each tooth passes through morphological stages such as initiation, bud, cap, and bell stages, followed by the eruption process, which has been well described in histological studies. [23]

The determination of dental age was conducted by examining the corresponding regions of the upper and lower jaws on soft file radiographs and comparing the findings with Al Qahtani's atlas. The observation process began with assessing the crowns and roots of the central incisors. If the crowns and roots of the central incisors are fully formed and the teeth had completely erupted, the observation was extended to other teeth, including the first molars, lateral incisors, second premolars, first premolars, canines, second molars, and third molars, using the same method. When the radiographic findings align with the Al Qahtani atlas, the dental age of the subject can be determined.[8]

Based on the radiographic image of the anterior tooth bud area of the lower jaw, a radiopaque appearance was observed in the enamel, along with a radiolucent intermediate appearance representing the tooth development and eruption are critical indicators for estimating age, as they progress from tooth bud formation to complete root development through well-defined morphological stages.

In this case, dental age estimation was performed using radiographs compared with the Al Qahtani atlas, determining the deceased male infant's age at 34 weeks in utero, with a margin of error of 1 month (7.5 to 9.5 months intra uteri). The findings were consistent with the atlas, although advanced decomposition had prevented tooth eruption. The adoption of the Al Qahtani method as a standard in forensic practice is strongly recommended, as its application enhances the accuracy of fetal age estimation, improves medical care, supports law enforcement, and informs legal rulings, ultimately contributing to better outcomes in both healthcare and justice systems.

The limitation of this case report lies in the absence of comparative age estimation measurements using alternative methods. The Al Qahtani method was the sole approach used for age estimation, resulting in no comparison or validation against other age estimation methods.

CONCLUSION

Tooth development and eruption are vital indicators for estimating age, progressing from tooth bud formation to root completion through distinct stages. In this case, dental age estimation using radiographs and the Al Qahtani atlas determined the deceased male infant's gestational age at 34 weeks in utero, with a range of 1 month (7.5 to 9.5 months intra uteri). The Al Qahtani demonstrated high accuracy, providing consistent and reliable results despite advanced decomposition and the absence of erupted teeth. The implication of the main findings is that dental age estimation, particularly utilizing the Al Qahtani atlas, serves as a highly reliable and accurate method for determining the gestational age of a deceased foetus, even in challenging scenarios like advanced decomposition or the absence of erupted teeth. This has significant applications in various fields, including forensic investigations, where it can aid in the investigation of suspected illegal or suspicious abortions by providing crucial evidence for identifying and prosecuting offenders. Moreover, in legal cases concerning abortion, this method supports judicial processes by providing accurate and objective data to assist courts in making informed and just decisions, especially in jurisdictions with gestational limits. In this case, the Al Qahtani method remained effective despite the absence of erupted teeth.

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