"Guilty!" Maybe not; Bite-Mark analysis as a Crime-Fighting tool Scrutinized, Deemed Inconclusive

Author: NLM.


MeSH: Bites, Human -- diagnosis (major); Crime (major); Forensic Dentistry -- legislation & jurisprudence (major); Humans; Skin -- pathology

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Author: Nolting, Frederick W; Anderson, Bridgett


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Dr. Golden responds

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Age estimation based on pulp chamber volume of first molars from cone-beam computed tomography images

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Abstract (English): AIM

To establish a method that can be used for human age estimation on the basis of pulp chamber volume of first molars and to identify whether the method is good enough for age estimation in real human cases.

MATERIALS AND METHODS

CBCT images of 373 maxillary first molars and 372 mandibular first molars were collected to establish the mathematical model from 190 female and 213 male patients whose age between 12 and 69 years old. The inclusion criteria of the first molars were: no caries, no excessive tooth wear, no dental restorations, no artifacts due to metal restorative materials present in adjacent teeth, and no pulpal calcification. All the CBCT images were acquired with a CBCT unit NewTom VG (Quantitative Radiology, Verona, Italy) and reconstructed with a voxel-size of 0.15mm. The images were subsequently exported as DICOM data sets and imported into an open source 3D image semi-
automatic segmenting and voxel-counting software ITK-SNAP 2.4 for the calculation of pulp chamber volumes. A logarithmic regression analysis was conducted with age as dependent variable and pulp chamber volume as independent variables to establish a mathematical model for the human age estimation. To identify the precision and accuracy of the model for human age estimation, another 104 maxillary first molars and 103 mandibular first molars from 55 female and 57 male patients whose age between 12 and 67 years old were collected, too. Mean absolute error and root mean square error between the actual age and estimated age were used to determine the precision and accuracy of the mathematical model. The study was approved by the Institutional Review Board of Peking University School and Hospital of Stomatology.

RESULTS

A mathematical model was suggested for: \( \text{AGE}=117.691-26.442 \times \ln(\text{pulp chamber volume}) \). The regression was statistically significant \((p=0.000<0.01)\). The coefficient of determination \((R^2)\) was 0.564. There is a mean absolute error of 8.122 and root mean square error of 5.603 between the actual age and estimated age for all the tested teeth.

CONCLUSION

The pulp chamber volume of first molar is a useful index for the estimation of human age with reasonable precision and accuracy.

MeSH: Adolescent; Adult; Age Determination by Teeth -- methods (major); Aged; Child; China; Cone-Beam Computed Tomography (major); Dental Pulp -- radiography (major); Female; Forensic Dentistry; Humans; Imaging, Three-Dimensional; Male; Middle Aged; Models, Biological; Molar -- radiography (major); Young Adult

Journal classification: Index Medicus

Identifier (keyword): Age estimation, Cone-beam CT, First molar, Forensic anthropology population data, Pulp chamber volume

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Application of third molar development and eruption models in estimating dental age in Malay sub-adults

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Abstract (English): The third molar development (TMD) has been widely utilized as one of the radiographic method for dental age estimation. By using the same radiograph of the same individual, third molar eruption (TME) information can be incorporated to the TMD regression model. This study aims to evaluate the performance of dental age estimation in individual method models and the combined model (TMD and TME) based on the classic regressions of multiple linear and principal component analysis. A sample of 705 digital panoramic radiographs of Malay sub-adults aged between 14.1 and 23.8 years was collected. The techniques described by Gleiser and Hunt (modified by Kohler) and Olze were employed to stage the TMD and TME, respectively. The data was divided to develop three respective models based on the two regressions of multiple linear and principal component analysis. The trained models were then validated on the test sample and the accuracy of age prediction was compared between each model. The coefficient of determination (R²) and root mean square error (RMSE) were calculated. In both genders, adjusted R² yielded an increment in the linear regressions of combined model as compared to the individual models. The overall decrease in RMSE was detected in combined model as compared to TMD (0.03-0.06) and TME (0.2-0.8). In principal component regression, low value of adjusted R(2) and high RMSE except in male were exhibited in combined model. Dental age estimation is better predicted using combined model in multiple linear regression models.
Measurements of developing teeth, and carpals and epiphyses of the ulna and radius for assessing new cut-offs at the age thresholds of 10, 11, 12, 13 and 14 years

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Abstract (English): The minimum age of criminal responsibility is the youngest age at which children may be held liable for infringements of penal laws. New cut-offs at the age thresholds of 10, 11, 12, 13 and 14 years were determined by applying three different methods: measurement of open apices in tooth roots (T); the ratio between the total area of carpal bones and epiphyses of the ulna and radius (HW); and the combined method (THW). The sample consisted of 291 Italian children (152 boys, 139 girls), aged between 5 and 15 years. The sensitivity and specificity were established. As regards THW, specificity reached the maximum of 95% in boys aged 10, and the minimum of 87% in boys aged 11. The best score of the Positive Predictive Value (PPV) was obtained in boys at 10 years with the THW method and the worst in girls of 12 with the HW method.

MeSH: Adolescent; Age Determination by Skeleton -- methods (major); Age Determination by Teeth -- methods (major); Carpal Bones -- growth & development (major); Carpal Bones -- radiography; Child; Child, Preschool; Cross-Sectional Studies; Epiphyses -- growth & development; Epiphyses -- radiography; Female; Forensic Anthropology; Forensic Dentistry; Humans; Italy; Male; Predictive Value of Tests; Radiography, Panoramic; Radius -- growth & development (major); Radius -- radiography; Retrospective Studies; Sensitivity and Specificity; Tooth -- growth & development; Tooth -- radiography; Tooth Apex -- growth & development (major); Tooth Apex -- radiography; Ulna -- growth & development (major); Ulna -- radiography

Journal classification: Index Medicus

Identifier (keyword): Age estimation, Cut-off, Forensic science, Hand-wrist bones, MACR, Teeth

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Forensic odontological observations in the victims of DANA air crash

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Abstract (English): INTRODUCTION

Forensic odontology or forensic dentistry is that aspect of forensic science that uses the application of dental science for the identification of unknown human remains and bite marks. Deaths resulting from mass disasters such as plane crash or fire incidence have always been given mass burial in Nigeria. This was obviously due to the fact that Forensic Pathologists whose roles involve disaster victim identification were not available at that time. However, in the DANA air crash in Lagos in 2012, the Forensic pathologist and dental teams were invited for the first time to identify the victims. The objectives of this paper are to identify the extent of victims' identification using Forensic odontology alone and its combination with DNA analysis. It also presents the pattern of fractures seen in the mandible and maxilla of the victims.

METHODS

The bodies were dissected using following the standard protocol dissection. Prior to this all the victims had Dental Radiological Examination. The oral cavities were exposed after which the Odontology team was invited for photographing first, followed by dental charting. Fractures of the mandible, maxilla including the anatomical regions were all recorded and photographed. Dental prosthesis, restorations, crowns and bridge and other findings were also noted, recorded and compared with ante mortem records where available.

RESULTS

A total of 152 bodies were recovered from the crash site while 148 victims were eventually identified through a combination of DNA analysis and forensic odontology. This represented 97.4%. Forensic odontology was the primary identifier in 10%. There were no fingerprinting information in this country.
at present therefore, it could not be used. A total of 89 (60\%) were males while females accounted for 59(40\%). This gives a ratio of 1.5:1. Most of the victims were in the age group 30-49 years; this represented 52\% of the victims while the least involved age groups were victims above 60 years of age which accounted for only 4.7\%. Mandibular fractures were seen in 29 victims, maxilla in 15, combined mandibulo/maxillary in 15 victims, while 89 victims had no jaw fracture. The most common area of fracture in the mandible was the body which accounted for 36.4\%, closely followed by parasymphyseal region 31.9\%, symphyseal 22.7\% and the angle 9.0\%. The most common fracture in the maxillae was palatal split fracture which accounted for 52\%, this was followed by pterygoid 24\%, alveolar 8\% and multiple locations 16\%.

CONCLUSION

A combination of DNA analysis and forensic odontology was able to identify a total of 148 victims out of 152 representing 97.4\%. Forensic odontology was the primary identifier in only 10\%. In the latter, poor and lack of dental records were responsible for this very low figure. The most common area of fracture in the mandible was the body which accounted for 36.4\%, while that of the maxillae was palatal fracture which accounted for 52\%. Padding of the back of the seats in the aircraft should be canvassed for to provide Cushing effect for passengers.


**MeSH:** Adult;Aircraft (major);DNA -- analysis;Disasters (major);Female;Forensic Dentistry (major);Humans;Male;Mandibular Fractures -- pathology;Mandibular Fractures -- radiography;Maxillary Fractures -- pathology;Maxillary Fractures -- radiography;Middle Aged;Nigeria;Radiography, Dental

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**Identifier (keyword):** dental records, forensic, fracture, identification, mandible, maxillae

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Application of age estimation methods based on teeth eruption: how easy is Olze method to use?

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Abstract (English): The development of new methods for age estimation has become with time an urgent issue because of the increasing immigration, in order to estimate accurately the age of those subjects who lack valid identity documents. Methods of age estimation are divided in skeletal and dental ones, and among the latter, Olze's method is one of the most recent, since it was introduced in 2010 with the aim to identify the legal age of 18 and 21 years by evaluating the different stages of development of the periodontal ligament of the third molars with closed root apices. The present study aims at verifying the applicability of the method to the daily forensic practice, with special focus on the interobserver repeatability. Olze's method was applied by three different observers (two physicians and one dentist without a specific training in Olze's method) to 61 orthopantomograms from subjects of mixed ethnicity aged between 16 and 51 years. The analysis took into consideration the lower third molars. The results provided by the different observers were then compared in order to verify the interobserver error. Results showed that interobserver error varies between 43 and 57 % for the right lower third molar (M48) and between 23 and 49 % for the left lower third molar (M38). Chi-square test did not show significant differences according to the side of teeth and type of professional figure. The results prove that Olze's method is not easy to apply when used by not adequately trained personnel, because of an intrinsic interobserver error. Since it is however a crucial method in age determination, it should be used only by experienced observers after an intensive and specific training.