H17 Model of Age Estimation Based on Dental Factors of Unknown Cadavers Among Iranians

Babak Faghih Monzavi, DDS, No 93351 Sanie Zadeh Lane-Chahar Bagh Bala Avenue, Esfahan 81638-93351, Iran; Arash Ghodoosi, MD, Fayz SquareForensic Medicine Center of Esfahan Province, Esfahan, Iran; Omid Savabi, DDS, MS, Azadi SquareHezar Jerib Avenue, Esfahan University of Medical Science, School of Dentistry, Esfahan, Iran; Asghar Karimi, DDS, Fayz Square - Forensic Medicine Center of Esfahan Province, Esfahan, Iran; Akbar Hasanzadeh, MS, Azadi SquareHezar Jerib Avenue, Esfahan University of Medical Sciences, School of Health Sciences, Esfahan, Iran*

After attending this presentation, attendees will be informed about age estimation of unknown human remains of Iranian ancestry based on dental techniques, including Gustafson's method.

This presentation will impact the forensic community and/or humanity by providing a more thorough understanding of dental aging techniques as applied to an Iranian skeletal population.

Estimation of age in unknown cadavers is an important method for their identification. The most common method in adults (older than 25 years) is the use of dental parameters as described by Gustafson in 1947. In 1950, he presented his models based on microscopic and macroscopic features of teeth. Pillai and Bhaskar (1974) showed that Gustafson's method is influenced by external factors such as race and culture in an Indian sample. Gustafson's method was used by Rahimian, Sabaghian and Savabi in Iran. In these two studies, the correlation coefficients between observed and estimated ages were .80 and .95, respectively. However, the models were never calculated. In Iran, age is estimated by formulae that were designed using a Swedish sample. Therefore, appropriate models for application to Iranian samples should be developed.

This study is a cross sectional study. The samples were selected from Iranian cadavers, examined at the Forensic Medicine Organization of Isfahan province. Their ages ranged from 25 to 60 years. This range was classified into five-year age groups. Thirty cases were selected for each group. The inclusion criterion was the presence of at least one single-root tooth on the mandible (premolar, canine or incisor). The cases were selected over a 9 month period. After tooth selection, the distance between sulcus of gingiva and cervix of tooth (CEJ) in the medial aspect of buccal surface was measured (in millimeters) with a probe to calculate the periodontosis factor. After extraction, the teeth were cleaned and put in tubes containing alcohol and glycerin. Alcohol allows for better presentation by dehydration of the translucent area of root.

For each case, variables such as name/surname, age, type of tooth, and the periodontosis factor (mm) were gathered. A non-stop Bego device was used to make sections ranging from .5 to 1.0 mm. Three teeth were deleted from the study due to previous treatment on their roots. Microscopic studies were done by stereomicroscope with a precision of
0.1 mm. The factors and their classifications are defined as the following: Periodontosis factor (P): ratio of distance between sulcus of gingiva and cervix of tooth (CEJ) to the root. P0: No periodontosis. P1: Beginning of periodontosis. P2: Periodontosis evident coronally on
more than one third of root.

Attrition factor (A): extent of destruction of crown. A0: No attrition. A1: Attrition up to enamel level. A2: Attrition up to dentin level. A3: Attrition up to pulp.

Secondary dentine factor (S): ratio of secondary generated dentin to the total volume of pulp cavity. S0: No secondary dentin. S1: Secondary dentin up to upper part of pulp cavity. S2: Secondary dentin up to half of pulp. S3: Diffuse calcification of the entire pulp.

Root resorption factor (R): extent of destruction of root due to resorption. R0: No resorption. R1: Spotted like resorption. R2: Root resorption at the level of cementum. R3: Extensive resorption of cementum and dentin.

Cementum apposition factor (C): extent of increment of cementum. C0: Normal thickness (undetectable). C1: Thickness more than normal (detectable). C2: Generation of thick cementum. C3: Hypercementosis thickness.

Translucency of the root factor (T): ratio of height of translucency area to the length of root. T0: No translucency. T1: Beginning of translucency of root. T2: Translucency more than 1/3 of apical root. T3: Translucency more than 2/3 of apical root.

Statistical analysis of this study is based on linear regression analysis, using sum of the ranks of the factors (SR) as predictor of age. Statistical analyses were done by SPSS.

A total of 210 cadavers comprising 185 males (88.1%) and 25 females (11.9%) were selected. Mean and standard deviation of SR is
6.72 (1.81). Correlation coefficients of age with attrition, periodontosis, root resorption, secondary dentine, cementum apposition and translucency of the root are .394 ($P<.001$), .384 ($P<.001$), .169 ($P=.014$), .522 ($P<.001$), .251 ($P<.001$) and .344 ($P<.001$), respectively. Coefficients of the regression line regardless of the tooth type are calculated as the following [$P_{(Constant)}<.001$, $P_{(SR)}<.001$, $R = .641$]:

$$Age = 16.948 + 3.697(SR)$$

 ** Presenting Author*

Calculation of the quartiles of error regardless of tooth type revealed that these errors were less than 2.5, 5.7 and 9.2 years in 25%, 50% and 75% of the subjects, respectively. Similarly, quartiles of error based on the 1st premolar model were 2.6, 4.7 and 7.1 years in 25%, 50% and 75% of the subjects, respectively.

There have been two major series of methods for age estimation based on dental parameters, including single and multiple factor methods. The multiple factor method was first used by Gustafson in 1947, using attrition, periodontosis, root resorption, secondary dentine, cementum apposition and translucency of the root. Mean error of estimation in his study was +/- 3.63 years. In 1962, Dalitz disregarded cementum apposition and root resorption. He presented his model by classifying the factor into five categories. The mean error of Gustafson's method was shown to be +/- 4.6 years by Haertig and co-authors (1985).

These studies show that different results with different accuracies based on dental factors can be due to different methodologies, race and environmental factors. In our study, the correlation coefficients of age with each of six single factors are less than the coefficient of age with sum of factors, indicating that the best estimation is achieved by combination of all six dental factors. Furthermore, mean errors of the models are +/- 6.4 in total teeth regardless of type and +/-5.2 years in 1st premolars, respectively. Therefore, the 1st premolar should be used in the first step among Iranians, when Gustafson's method is used for age estimation.

The reason for errors using Gustafson's method for age estimation of Iranians is low variability of dental factors in different ages. It can be due to congenital and environmental patterns including eating habits, which seems to be a determinant of dental factors. Despite these problems, the model is a cheaper, easier and more practical method and should be used as a first step before more sophisticated methods of age estimation in unknown cadavers.

Dalitz GD. Age determination of adult human remains by teeth examination. *J Forensic Science Society*, 1962;3:11-21.

Gustafson G. Microscopic examination of the teeth as a means of identification in forensic medicine. J Amer Dental Assoc, 1947;35:720-724. Gustafson G. Age determination on teeth. *J Amer Dental Assoc*, 1950;41:45-54.

Haertig A, Crainic K, Durigon M. *Medicolegal identification by the dental system*. Presse Med 1985; 14(9):543-545.

Pillai PS, Bhaskar GR. Age estimation from teeth using Gustafson's method. *J Forensic Sciences*, 1974; 3:135-141.

Age Estimation, Gustafson's Method, Dental Factors

 ** Presenting Author*