

## Case Report

### Age Estimation of Institutionalized Individuals for Legal Purposes

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## Abstract

Forensic Dentistry and Legal Medicine provide tools which help justice to obtain a biological profile of individuals who lack identification or the origin of their citizenship. This study aimed to present the procedure for age estimation of adults through a case report. The regressive alterations of the teeth taken from panoramic radiographs were used as parameters for the procedure for estimating age in adults. In order to help the process of applying for retirement benefits, n=30 institutionalized men, who did not have civil registration records, were examined. The ratings were performed using radiography, and assessed by two observers, who scored them according to the level or degree of alteration. They considered the phenomena of dental involution and followed a change in Gustafson's method. It was possible to use the method in n=18 individuals and the values were included in a spreadsheet to obtain the numerical value of the age. It was concluded that, despite its limitations, the use of these parameters is a resourceful tool to perform age estimation as it helps the individuals who do not have registration records to obtain their benefits.

**Keywords:** Forensic Dentistry; Anthropology; Age Determination by Teeth

## Introduction

Age estimation can be defined as the procedure which assesses the stages of evolution and involution in the body [1]. Human beings undergo three developmental stages throughout their life cycle: growth, stabilization and aging/involution. Thus, by assessing the morphological features of these phases, it is possible to establish the age range which is compatible with the individual's current life stage [2,3].

Age estimation is an important tool for individuals, especially when it concerns age for legal reasons, such as

situations in which criminals claim to be under 18 years-old, crimes against children and adolescents, child support cases, retirement cases and other cases where knowledge of the individual's age may establish the status of the process and contribute to its finalization [2].

A range of methods can be used for those purposes, including macroscopic anatomical features of individuals (from embryonic stage to adulthood), ossification center of long bones and carpal bones, analysis of growth changes in the skull and face, and dental checking [4]. The dental method is very helpful, since the teeth suffer less interference from

systemic factors, and enables an analysis of a considerable amount of data [5].

Thus, the study aimed to present the procedure for age estimation of n=30 institutionalized adults who did not have civil registration records. The procedure is presented through a case report and the regressive alterations of the teeth taken from panoramic radiographs were used as parameters for estimating age in adults.

### Case Report

The present study was submitted to the Research Ethics Committee and was approved under the ethics assessment certificate (CAAE) number 017/2011.

A sample of n=30 institutionalized men was referred through legal channels in order to request an assessment of age estimation. They had a history of lack or loss of birth certificates.

Clinical tests were performed to check the presence or lack of teeth, and, subsequently, periapical and panoramic radiographic examinations were performed. The following individuals were excluded from the study: individuals with decayed upper anterior teeth, restored teeth, and those without any teeth.

Gustafson [6] described the method in which the regressive alterations of the teeth were used as parameters for estimating age in adults. The original study is based on the analysis of histological slides with friction. Six parameters of late alterations of the teeth are considered (occlusal surface wear, formation of secondary dentin in pulp cavity, transparency of radicular apex, periodontosis, deposition of cement in the root canal, and radicular resorption). Values ranging from 0 to 3 were attributed according to the intensity. A formula was used to score qualitatively alterations which are related to the age, and showed error in the estimated age of approximately 3.6 years.

It was possible to use the method in n=18 individuals who had intact single-root teeth, i.e. there were no carious lesions or restorations in the upper arch. The remaining n=12 individuals were excluded, since n=6 of them did not have any teeth remaining (totally edentulous individuals), n=4 of them did not carry out the requested examinations and n=2 of them did not have intact teeth.

Radiographic films were used in order to assess each phenomenon related to dental regression concerning intact single-root teeth. These data were analyzed by two professionals, who attributed scores ranging from 0 to 3, according to the intensity or degree of alteration. The sum of the scores was calculated, and the approximate age was

obtained from straight regression lines.

In order to obtain the test results, an integrated computerized system (SISCRO software) was used [13]. The scores were included twice in the system and set a deviation of 5.38 years. After the inclusion of all data, the numerical value of the age was obtained.

### Results

According to the data from the changed Gustafson's method, the following scores were observed (Table 1): occlusal surface wear (A); periodontosis (P), formation of secondary dentin in pulp cavity (S); transparency of radicular apex (T); deposition of cement in the root canal (C); and radicular resorption (R)

**Table 1.** Scores from the changed Gustafson's method, Institutionalized Individuals.

Individual	A	P	S	C	R	T
1	2	2	1	2	1	1
2	2	2	2	1	1	1
3	2	2	2	1	2	1
4	2	2	1	1	1	0
5	0	1	2	1	1	2
6	2	2	2	2	2	1
7	1	1	2	1	1	1
8	1	2	1	1	2	1
9	1	1	1	1	2	0
10	2	2	1	1	1	0
11	2	1	2	2	2	2
12	1	3	1	1	1	0
13	1	2	2	1	1	0
14	2	2	0	0	2	1
15	1	2	1	1	2	0
16	1	1	1	1	1	0
17	1	0	2	1	0	0
18	2	2	0	0	2	0

According to the integrated computerized system (SISCRO software) and setting a deviation of 5.38 years, the results obtained from the assessment of the scores can be observed in Table 2.

**Table 2.** Results from Gustafson's method (1950), Institutionalized Individuals.

Individual	Estimated Age	Minimum Age	Maximum Age
1	52 years and 5 months	49.77 years	55.16 years
2	52 years and 5 months	49.77 years	55.16 years
3	57 years	54.33 years	59.72 years
4	43 years and 4 months	40.65 years	46.04 years
5	43 years and 4 months	40.65 years	46.04 years
6	61 years and 7 months	58.59 years	64.28 years
7	43 years and 4 months	40.65 years	46.04 years
8	47 years and 10 months	45.21 years	50.6 years
9	38 years and 9 months	36.09 years	41.48 years
10	43 years and 4 months	40.65 years	46.04 years
11	61 years and 7 months	58.59 years	64.28 years
12	43 years and 4 months	40.65 years	46.04 years
13	43 years and 4 months	40.65 years	46.04 years
14	43 years and 4 months	40.65 years	46.04 years
15	43 years and 4 months	40.65 years	46.04 years
16	34 years and 2 months	31.53 years	36.92 years
17	29 years and 8 months	29.97 years	32.36 years
18	38 years and 9 months	36.09 years	41.48 years

## Discussion

There are a range of methods available in literature to estimate an individual's age. The main analyzed factors are: hand and wrist radiographies, assessment of long bones, sternoclavicular articulation, development of secondary sexual features and dental development [7].

The analysis of teeth is regarded as a good parameter for age

estimation, since the dental development is less affected by endocrine alterations than other tissues [8]. Furthermore, comparing to the methods which assess the morphological and skeletal features, dental elements suffer less interference from factors such as gender, race, diet, weather, systemic illnesses, among others, which change the chronology of tooth eruption. Therefore, methods which assess mineralization, tooth eruption and regression are used for estimating age [3, 9].

Estimating age through dental assessment is basically divided into methods which assess tooth formation and eruption and those which evaluate its regression or involution. The dental development begins in the embryonic stage and reaches maturity at the age of 21 years. On the one hand, the younger the age, the higher the amount of information, due to the number of teeth being formed. On the other hand, as the teeth mature, the amount of information decreases until it is restricted to third molars, i.e. the last teeth developed [11-13]. The organic regression or ageing process starts from maturation. Thus, if it is necessary to estimate the age of adults, their ageing data should be considered [3].

The pioneering method for estimating age in completely formed teeth was proposed by Gustafson [6], who developed a formula to score qualitatively alterations related to the age through histological analysis. According to the results from Reppien et al. [8], Gustafson's method is still being used for estimation since it demonstrates good results [8].

Gustafson's method [6] considers factors such as friction, deposition of secondary dentin, apposition of cementum, periodontosis, radicular resorption, and radicular translucency. Some of these factors have been studied independently. However, some of them have been combined in estimates and the method has been tested [15-17].

This method is limited by the fact that direct histological examination is required [6]. By comparing a variety of methods for estimating age in adults, Soomer et al [18] concluded that the methods which use analysis of extracted tooth are more reliable than those which do not. Nevertheless, it is unfeasible to extract a healthy tooth from living individuals.

Thus, it is necessary to adapt the original method in living individuals, and this is done through the use of radiographic analysis [4]. Under such circumstances, the method should be adapted to the available resources due to the fact that radiographic images cannot reproduce faithfully the real histological situation, as it has been demonstrated in studies on dental development [3].

It was possible to use radiographs in this adaptation since, according to a study from Matsikidis [12], the features chosen

by Gustafson [6] can be observed in conventional dental radiography, and its assessment enables us to estimate the individual's chronological age. In contrast to what was observed by that author, Olze et al [19] stated that it was not possible to reproduce an analysis of every regression stage in panoramic radiographs. Therefore, some features were excluded from their analyses. In this investigation it was chosen to follow the analyses available in the original method, since the experts considered it to be possible to assess all the features.

Nkhumeleni et al [20] concluded that Gustafson's arguments for ensuring the use of the method are invalid, as the standard estimation error would be 7.03 years rather than 3.06 years, as originally described. Therefore, this study has considered a standard error of 5.38 years, which is the average of the data from both authors.

De Luca [21] stated that the methods for age estimation tend to be more reliable when used in young individuals and, as individuals grow older, the methods become less reliable due to the low individual variability of morphological features in children and young adults, who are prone to a small degree of error. A low degree of agreement was found in individuals who are older than 45-50 years, due to human senescence, which leads to less precise results when performing morphological methods for estimating age [21]. According to Travassos & Silva [10], Gustafson's method tends to overestimate the age of individuals under 35 and underestimate the age of those who are over 60. In this study, the actual ages were unknown. However, it was noted that out of the 18 individuals, only two of them had an estimated age under 35, whereas the other 16 individuals reported ages over 35. Thus, it could mean that the individuals who have a higher estimated value could still be underestimated and the true age could be older.

According to Gustafson [6], the estimation can match the actual age or not, but it can be dependent on it to a greater or lesser extent, as there is always a great variation around the average estimate. Therefore, the use of this method for forensic purposes may consider that the individual is within a range of approximately 11 years, which would be inadequate for estimation needs.

The aim of this study was to perform age estimation in adults who did not have civil registration until the moment. This fact was taken into consideration, despite the limitations of the method. Yet, it was impossible to use it with some individuals who had been examined. Thus, it is evident that the method for estimating age needs to be tested and validated, especially when it entails estimating the age of adults. This leads to the creation of protocols for such cases, and aims to facilitate and guide the investigation.

## Conclusion

It is concluded that the use of those parameters, despite their limitations as described above, is still an important tool for performing age estimation which aims to help the individuals who do not have registration records to obtain their benefits.

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