Reliability of dental root translucency in age estimation among adults aged between 25 to 60 Years – An autopsy study

SantoshSheelavant, Dr.Manjula Patil¹

Department of Forensic Medicine, ¹Department of Anatomy,
S. N Medical College, Bagalkot, Karnataka, India.

Abstract

Introduction: Age is one of the essential factors in establishing the identity. Teeth being the strongest parts in human body and very resistant to external influences they are available for examination in all eventualities. At no time of life, an individual’s tooth unit is static. They are many physiological changes which are appreciable with increasing age. Among them dental root translucency in age estimation is found to be of more help by researchers. This study was carried out to determine the reliability of the dental root translucency in estimating the age of an individual.

Material and methods: Maxillary first premolar tooth was extracted from the bodies subjected for medico legal autopsy at the Department of Forensic Medicine, S N Medical College, Bagalkot, after taking consent from the person in lawful possession of the body. A total of 40 cases were studied in the age group of 25-60 years. Authentic document of date of birth collected from legal heirs. Dental root translucency noted and scored according to Gustafson’s method.

Results: The dental root translucency is a significant factor that can be used to estimate age (P<0.001, R² = 76.5%). Regression formulawas derived from the graph obtained by plotting Dental root factor against actual age. Age estimation from dental root translucency gave the deviation, i.e. ±5.17 years which is least. Thus root translucency can estimate the age with near accuracy.

Conclusion: Dental root translucency is the best parameter to estimate the age based upon physiological changes in teeth with least deviation when age estimation done using single parameter.

Key words: Age estimation, Gustafson’s method, Dental root translucency

Address for Correspondence

Dr.ManjulaPatil, Assistant ProfessorDepartment Of Anatomy
S. N Medical College, Bagalkot-587102
Email: drmanjulapatil@gmail.com

Introduction
Identification is the establishment of the individuality of a person and age is one of the essential factors in establishing the identity. Over the years researchers have estimated the age by various methods by collectively relying on the physical changes, secondary sexual characters, radiological examination of ossification centers and also for eruption of temporary and permanent teeth not only in dead but also in living individuals whose chronological age is under dispute and they have been successful in ascertaining the age quite accurately up to age 25 years. However for estimation of age beyond 25 years it has proved difficult [1]. Teeth in many ways form a unique part of the human body as they are most durable and resilient part of the skeleton [2] and are very resistant to external influences like putrefaction, fire, explosions, and chemicals etc., which make them available for examination in all eventualities [3]. Teeth apart from its role as a partial identification feature by virtue of its peculiarities and comparable data of dental procedures, is also an ideal source for the estimation of the chronological age. At no time during life of an individual tooth unit is static. It is constantly undergoing changes of one sort or another e.g. eruption, tilting or even lateral movement through jaw. Other changes which are appreciable with increasing age are attrition, periodontal disease, deposition of secondary dentine, root translucency, cementum apposition, root resorption, color changes and increase in root roughness. By taking into consideration these secondary changes in teeth with advancing age, various studies were done to estimate the age of an individual. Gustafson (1950) was first to note the morphological changes in the structure of teeth. These changes are:

- **Attrition** - the gradual wear of the enamel on the occlusal surface,
- **Periodontosis** - retraction of gum margins and loosening of teeth,
- **Secondary dentine deposition** - age related build up of dentine on the walls of the pulp chamber,
- **Cementum apposition** - continuous repositioning of the tooth in the alveolar bone,
- **Root translucency** - the tendency of root dentine in thick section to appear to be transparent in the transmitted light from the apex upwards,
- **Root resorption** - the gradual resorption of the root apex (appreciable microscopically) (Figure 1).[4]

Figure 1: Six physiological changes in teeth (Observed by Gustafson, 1950)

Among the 6 parameters of physiological changes in teeth, dental root translucency found to be of more help in many previously conducted studies.

In developing countries like India large numbers of people are illiterate and have no knowledge of their date of birth, which is required by law enforcing agencies as proof of age in civil, criminal issues, for awarding compensation.

Hence this study is taken up to estimate the age from dental root translucency (Gustafson method) and to compare it with the actual age of deceased person as ascertained by birth date records and note the difference between estimated age and actual age, so as to develop a reliable data for estimation of age in individuals whose birth records are unavailable.

Material and Methods

Maxillary first premolar teeth were extracted from the bodies subjected for...
medico legal autopsy at the Department of Forensic Medicine, S N Medical College, Bagalkot, after taking consent from the person in lawful possession of the body. A total of 40 cases were studied in the age group of 25-60 years, which were grouped as under - Group I: 25 - 30 years, Group II: 31 - 35 years, Group III: 36 - 40 years, Group IV: 41 - 45 years, Group V: 46 - 50 years, Group VI: 51 - 55 years, Group VII: 56 - 60 years.

Method of collection of data:
Certified document of date of birth viz, birth certificate/ marks card/driving license as a proof of actual age was collected from relatives.

Inclusion criteria:
1. Randomly selected cases between 25 to 60 years age group with the document certifying the actual age.
2. Maxillary first premolar tooth were taken for the study. (right or left)

Exclusion criteria:
1. Tooth with caries and fillings observed during the process of extraction or during ground sectioning.

Method:
In our study first premolars were only considered as they gave strongest coefficient [3, 5]. Then the tooth was extracted with extraction forceps and preserved in formalin for a period of 15 – 17 days. Then the ground section was prepared.

Preparation of the ground section:
Tooth were sectioned into two halves using high speed metal grinder (2600 rps), and then grinding was done manually with rough carborundum stone till a thickness of 1 mm, at this thickness, the root translucency was noted (Figure 2). According to degree of structural change, each change was ranked arbitrarily and scored as 0, 1, 2 and 3. T0 - No translucency, T1 - Beginning of translucency, T2 - Translucency more than 1/3rd of the apical root, T3 - Translucency more than 2/3rd of the apical root. (Figure 3)[4].

Results:
Table 1: Distribution of cases according to age
Table 1 shows that a total of 40 cases were studied with age ranging between 25 – 60 years and divided into 7 groups at 5 years interval.

Table 2: Calculated age using age regression equation derived by scoring root translucency (RT) Formula: \( y=14.67x+20.25 \)

Table 2 shows that, the parameter Root Translucency is a significant factor that can be used to estimate age (\( P<0.001, R^2 = 76.5\% \)). Higher R2 value indicates that this parameter can give better estimate of the actual age. These findings are similar to Bang and Ram, where a mean error of estimation of ± 4.7 years in 58% cases and ± 10 years in 79% of subjects. [6]

Table 3: Maximum and minimum deviation in the estimated age using dental root translucency

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental root translucency</td>
<td>0.10</td>
</tr>
</tbody>
</table>
Table 3 shows, Minimum deviation of 0.10 and maximum deviation of 10.10 which indicates that the dental root translucency is significant factor in age estimation.

Table 4: Comparison of actual age with calculated age by dental root translucency

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Actual age (Mean ±SD)</th>
<th>Estimated age (Mean ±SD)</th>
<th>Mean difference</th>
<th>T value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root translucency</td>
<td>40.42 ±10.53</td>
<td>40.41 ±9.229</td>
<td>0.01</td>
<td>0.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Table 4 shows, that there is mean difference between actual age and the calculated age is only 0.012 (P value 0.996)

Discussion

Gustafson (1950) was first to note the morphological changes in the structure of teeth. These changes are:

- **Attrition** - the gradual wear of the enamel on the occlusal surface,
- **Periodontosis** – retraction of gum margins and loosening of teeth,
- **Secondary dentine deposition** - age related build up of dentine on the walls of the pulpal chamber,
- **Cementum apposition** - continuous repositioning of the tooth in the alveolar bone,
- **Root translucency** - the tendency of root dentine in thick section to appear to be transparent in the transmitted light from the apex upwards,
- **Root resorption** - the gradual resorption of the root apex (appreciable microscopically)

Gustafson awarded a scores of 0-3 based upon visual severity of changes and estimated age and calculated age using the regression formula derived from his observation: Y =3.52 X + 8.88 (X = Total Score and Y = Estimated Age) and established that the difference between calculated age and actual age would not exceed ±3.63 years in 33% of cases, ± 7.3 years in 4.5%cases, ±9.1 years in 1% of cases and ±10.9 years in 0.3% cases.

The use of dentine translucency alone for estimating age and significant increase in root translucency with age was reported. Root dentine starts to become translucent during third decade of life beginning at the apex and advancing coronally. For age estimation, translucency length (mm) or area (in mm2) may be measured either manually or by computer image analysis. Length of translucency has greater correlation with age, for which two equations were given: Age = B0+B1X+B2X2 for zones of translucency <9mm and Age= B0+B1X for zones >9mm, where B is regression constant, B1 and B2 are regression efficient and X is translucency length. They found a mean error of estimation of ± 4.7 years in 58% cases and ± 10 years in 79% of subjects.

A total of 210 teeth ranging between 25 to 60 years including 185 males and 25 females were studied. By using 0.5 – 1 mm section of tooth, determined root translucency was found 0.344 (p < 0.001)

A technique to study single rooted tooth is based on measurement of two dental features: periodontosis height times 100/root height (P) and Transparency of the root height times 100/ root height (T). Their sample consisted of 135 males, 73 females, 198 whites and 10 blacks. The sample ranged from 22 years to 90 years. By using formula (A =0.18 x P +0.42 x T + 25.53, where A =Age in years, P = Periodontosis X 100/root height and T=Translucency
height X 100/root height), were able to calculate the age at death with an error between the actual age and calculated age, of ± 10 years on their working sample and ± 8 years on a forensic control sample[9,10].

In our study the parameter Root Translucency is a significant factor that can be used to estimate age (P<0.001, R2 =76.5%). Higher R2 value indicates that this parameter can give better estimate of the actual age. These findings are similar to Bang and Ram, where a mean error of estimation of ± 4.7 years in 58% cases and ± 10 years in 79% of subjects[6].

**Conclusions:**

Dental root translucency was observed in 40 cases. Regression formulas were derived from the graph obtained by plotting Dental root factor against actual age. Age estimation from dental root translucency gave the deviation, i.e. ±5.17 years which is least. Thus root translucency can estimate the age with near accuracy.

**References:**


