Variation in SPC/STC Ratio as an Indicator of Age: A Computer-aided Forensic Odontology

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INTRODUCTION

Aging refers to the irreversible and inevitable change that occurs with time in all aspects of human body. The estimation of age can play an important part in the forensic identification.1 Due to resistance to physical damage, teeth may be the only skeletal evidence remaining in a sufficiently undamaged condition to permit useful examination. In addition to the importance of age estimation for identification purposes, the assessment of age may have a particular medicolegal significance.2

In forensic odontology, different parts of teeth can be used to predict an individual’s age. The amount of secondary dentin in a tooth has been used as one of several parameters in methods for age estimation. Dentin deposition is an ongoing process in human teeth. After complete formation of primary dentin and closure of the root apex with advancing age, the size of pulp chamber decreases due to formation of secondary dentin along the wall of the pulp chamber. These changes can be used as biomarker for indicator of age in forensic odontology.3 The objective of the present study was to evaluate the change in pulp width at the level of cemento-enamel junction (C-E junction) and its correlation to different age groups.

MATERIALS AND METHODS

The study was carried out in the Department of Oral Pathology and Microbiology at SPDC, Wardha (MH). It is a retrospective study in which we are going to see the changes in pulp width as age increases. 100 extracted maxillary first premolars were made up to the midpulpal area in labiolingual plane. The correlation of different age group with reduction in ratio of score of pulp width (SPC) and score of tooth width (STC) at cemento-enamel junction was done. All teeth were examined under stereomicroscope then SPC and STC were measured by Leica Qwin software.

RESULTS

The findings of our study suggest that as the age increases SPC/STC ratio decreases (Table 1 and Graph 1). SPC/STC ratio is directly proportional to pulp width and inversely proportional to amount of secondary dentin formation. Pearson correlation coefficient (r) was found -0.9947 and p-value is < 0.001, which is considered extremely significant. So, SPC/STC ratio with different age groups was found to be statistically significant. Amount of secondary dentin is an indicator of age.

DISCUSSION

Secondary dentin may be defined as the dentin formed continuously throughout life after the crown is fully formed.4 Formation of secondary dentin starts at the side of the pulp where the antagonist meets the tooth during mastication and seems to be mainly related to age.5 According to Gustafson,6 secondary dentin deposition was used as one of the parameters for age estimation. The teeth in this study originated from different sources and care was taken so as to exclude the teeth affected by pathological condition, which affect
cemento-enamel junction. Teeth to be studied were selected and this selection is made based on the study of Solheim (1980) with priority given to first premolars. In half-sectioned teeth, it is difficult to determine the borderline between primary and secondary dentin. Therefore pulp width, which is easy to measure, was taken as an indirect expression of the amount of secondary dentin. As the width of the pulp may depend on the size of tooth, the total tooth width was measured at same levels as the pulp width and the ratio between pulp width and total tooth width was calculated. So, measurements of amount of secondary dentin seem to be a reliable method in forensic aspect. The results confirm the findings that secondary dentin formation is closely related to age.

### Table 1: Descriptive statistics

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Mean age ± SD</th>
<th>SPC/STC ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20</td>
<td>16.60 ± 1.51</td>
<td>0.58 ± 0.007</td>
</tr>
<tr>
<td>21-25</td>
<td>22.80 ± 1.78</td>
<td>0.56 ± 0.10</td>
</tr>
<tr>
<td>26-30</td>
<td>27.80 ± 0.83</td>
<td>0.52 ± 0.01</td>
</tr>
<tr>
<td>31-35</td>
<td>32.20 ± 1.64</td>
<td>0.49 ± 0.005</td>
</tr>
<tr>
<td>36-40</td>
<td>38.00 ± 1.58</td>
<td>0.47 ± 0.005</td>
</tr>
<tr>
<td>41-45</td>
<td>42.40 ± 1.67</td>
<td>0.44 ± 0.008</td>
</tr>
<tr>
<td>46-50</td>
<td>47.20 ± 1.64</td>
<td>0.42 ± 0.005</td>
</tr>
<tr>
<td>51-55</td>
<td>52.80 ± 1.48</td>
<td>0.40 ± 0.005</td>
</tr>
<tr>
<td>56-60</td>
<td>57.20 ± 1.30</td>
<td>0.38 ± 0.008</td>
</tr>
<tr>
<td>61-65</td>
<td>62.60 ± 1.51</td>
<td>0.36 ± 0.008</td>
</tr>
</tbody>
</table>

Graph 1: Pearson correlation coefficient ($r$) was found $-0.9947$ and p value is $<0.001$, considered extremely significant.
Our result is in concordance with studies of Solheim et al.,7 Kvall et al.,8 Bosman et al.,9 Cameriere et al.10 They suggested that the width of pulp is a better indicator of age. This result is also in concordance with studies of Lantelme RL et al11 and Solheim T3. They suggested that pulp widths were most strongly correlated with age in the cervical area and the correlation decreased towards the apex. The quotient between pulp and tooth width was also calculated, as broader teeth might have wider pulp. In our study, we also found that gender had no significant influence on age. This is in accordance with the original study carried out by Cameriere et al.10 In the due course of study, we however also found that computer-aided12 forensic odontology gives rapid and reproducible result as compared to routine radiographic method because when the curve arch of the jaw is projected on to a flat film, there will always be a certain amount of distortion while measuring the image presented there. Our this observation is in accordance with the study of Singaraju S et al.13

**CONCLUSION**

The amount of secondary dentin formation plays an important role in forensic odontology as it increases with increasing age and leads to reduction in the pulp chamber. Computer-aided study of teeth is relatively rapid method and provides reproducible results. Although, the sample size of this study was only 100 teeth but still it proves to be a reliable marker for age estimation, which was based only on the measurement of amount of secondary dentin.

**REFERENCES**