Estimation Of Dental Age Using Coronal Pulp Cavity Index (CPCI) On Lower Second Premolar And First Molar With Periapical Radiographic Analysis

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Abstract
Estimation of dental age in forensic odontology is crucial in biological dentistry. Coronal Pulp Cavity Index (CPCI) as one method to check the correlation between the reduction of the coronal pulp cavity and chronological age. The present study aims to find out whether CPCI method can be used to estimate the dental age on lower second premolar and first molar with periapical radiographic analysis. The cross sectional study was conducted on 60 patients (30 males and 30 females) in the age range of 21 and 30 years. They were subjected to periapical radiographs on lower second premolar and first molar. The Coronal Pulp Cavity Height (CPCH) and Coronal Length (CL) was measured using vision measuring scope DC 3000 and electronic digital caliper. The values obtained were subjected into the formula of $TIC = \frac{CPCH \times 100}{CL}$. The mean of TCI score and average chronological age were analyzed using paired T test to find out the correlation between the chronological age and the estimated dental age, $P > 0.05$ is considered as significant. There was no significant difference between the estimated dental age and chronological age in both lower second premolars ($p=0.119$) and first molars ($p=0.224$). CPCI method can be used to estimate the dental age on healthy lower second premolar and first molar.

INTRODUCTION

Forensic odontology is a branch of forensic medicine with the proper handling and examination of dental evidence and with proper evaluation and presentation of dental findings mostly in criminal issues. (Indira et al., 2015; Sakhdari et al., 2015; Badar et al., 2016). DA et al. (2015) studied the accuracy of age estimation from TCI of mandibular premolars and molars using panaromic radiographs to develop regression equations that can be used in the Egyptians. (DA et al., 2015). One of the unique characteristics of human morphology is the human dentition that withstands the test of the time and temperature. Treatment given by a dentist is the biggest contribution to the uniqueness of an individual dentition and is the key in the identification of oral cavity. (Priyadharshini et al., 2015). Age determination has become important in forensic science not only for the identification of corpses, but also for living individuals in a multicultural society, to clarify legal queries in delineating juvenile and young adults in spheres pertaining to employment, labour acts and criminal offences. Teeth can...
be used as an indicator for age assessment morphologically, histologically and radiographically. (Chandramala, 2012) Some studies reported about the reduction of the coronal pulp cavity and the chronological age and proved that CPCI can be used to estimate age through digital radiograph for a forensic context. (Drusini, 2008; Burhan and Nawaya, 2016; Afify, 2014)

Digital radiographs is a tool to measure morphological parameters of teeth precisely. (Afify, 2014; Veera et al., 2014) Non invasive radiography been developed for measurements of reduction in pulp cavity and secondary dentin formation. (Sakhdari et al., 2015; Priyadharsini et al., 2015) Size of pulp chamber, will reduce with age, shows a relationship with chronological age. (DA et al., 2015; Veera et al., 2014; Mehta et al., 2017) However, the limitation of panoramic radiographs has been reported not adequate for accurate age estimation in the past four decades. (Godge et al., 2014) Since the limitation of panoramic radiogaph, this study was conducted to determine dental age using the Coronal Pulp Cavity Index (CPCI) method of second premolar and mandibular first molars with periapical radiographic analysis.

MATERIALS AND METHODS

The cross sectional study was conducted on 60 healthy patients who came for dental treatment in Dental Hospital, Universitas Sumatera Utara in the age range of 21 and 30 years in the period of March till June 2019. The study was obtained an approval from Health Research Ethical Committee of Sumatera Utara (441/TGL/KEPK FK USU- RSUP HAM/2019). Subject of research with intact lower premolar and first molar from any of the sides in good morphological feature was chosen. Patients with any of premolar or molars with caries, periapical lesions, anomalies or tooth loss, tooth with fillings, root canal treatment were excluded.

Patients were subjected to intraoral periapical radiographs with an exposure of 70kV 8mA. The measurements were done at fully visible lower first premolar and first molar on the radiographs taken. The Coronal Pulp Cavity Height (CPCH) was measured vertically from the cervical line to the tip of the highest pulp horn. The Coronal Length (CL) was measured vertically from this cervical line to the tip of the highest cusp. (Veera et al., 2014) Both detailed reference points (Figure 1) were measured using Vision measuring scope DC 3000 with the precision of 0.001mm. the measurements were taken twice with a 0.1mm precision using electronic digital caliper to avoid errors. The values obtained were subjected into the formula of TCI = [CPCH × 100]/CH.

The mean data of TCI score and average chronological age collected were processed using statistically processed through computerized Statistical Package for Social Sciences (SPSS) software and analyzed through paired T test to find out the correlation between the chronological age and the estimated dental age.

RESULTS

The analysis of the studied number of subjects is summarized in Table 1. It shows the number of dental samples distributions in 30 males (50%) and 30 female patients (50%). From the results of the analysis it was proven that the sample distribution of men was as much as that of women, which was 50% each (n = 30).

Table 2 shows the estimated age using CPCI method in lower second premolar and first molar using periapical radiographic analysis. The estimated dental age in lower second premolar using the CPCI method was 25.67 ± 3.09 and had no significant difference (p=0.2). The dental age estimation in lower first molar was 25.61±2.94 and had no significant difference (p=0.2).

Analysis in Table 3, shows the p value from paired t test which is p = 0.119. There is no significant difference in chronological age and estimated dental age in lower second premolar based on the value from TCI formula, the hypothesis is accepted. As the result, the CPCI method can be used to estimate dental age in lower second premolar.

Table 4 proves that the p value of paired t test is p = 0.224. There is no difference in chronological age and estimated dental age of lower first molar based on the value from TCI formula, the hypothesis is accepted. As the result, the CPCI method can be used to estimate the dental age of lower first molar.

The correlation between TCI and different age groups of subjects is represented in Table 5. There is a positive correlation between age and TCI. The correlation of TCI on both lower premolar and first molar is more at the age groups of 21-22 years (0.673), 23-24 years(0.09) and a poor correlation was observed at the higher age groups. The lower second premolar has a higher significant correlation compared to first molar.

DISCUSSION

This study was conducted to determine whether the CPCI method can be used to estimate the dental age...
**Table 1: Distribution of tooth sample according to sex**

|                  | Lower second premolar/ first molar | Female |
|------------------|------------------------------------|--------|
|                  | Male                               | N      | %    | N   | %    |
|                  | Male                               | 30     | 50   | 30  | 50   |

**Table 2: Distribution of estimated dental age on lower second premolar and first molar according to TCI values**

| Dental age (TCI) | N    | Mean±Sd | Median | Max | Min | Norm test |
|------------------|------|---------|--------|-----|-----|-----------|
| P2               | 60   | 25.67±3.09 | 25.65  | 31.98 | 20.75 | 0.200*    |
| M1               | 60   | 25.61±2.94 | 25.58  | 31.44 | 21.10 | 0.085*    |

*Kolmogorov-Smirnov > 0.05= normal*

**Table 3: Statistical analysis of comparison between chronological age and dental age of lower second premolar based on TCI values**

|                  | N    | Mean   | Sd    | P    |
|------------------|------|--------|-------|------|
| Chronological age| 60   | 25.47  | 2.91  | 0.119|
| Dental age of lower second premolar(TCI) | 60   | 25.67  | 3.09  |      |

*p>0.05*

**Table 4: Statistical analysis of comparison between chronological age and dental age of lower first molar based on TCI values**

|                  | N    | Mean   | Sd    | P    |
|------------------|------|--------|-------|------|
| Chronological age| 60   | 25.47  | 2.91  | 0.224|
| Dental age of lower second premolar(TCI) | 60   | 25.61  | 2.94  |      |

*p >0.05*
Table 5: Pearson Correlation of different age groups with TCI in lower second premolar and first molar

| Age in years | 2nd Premolar | 1st Molar | Combined |
|--------------|--------------|-----------|----------|
|              | r            | p         | r        | p         | r        | p         |
| 21-22        | 0.796**      | 0.002     | 0.176    | 0.585     | 0.673*   | 0.016     |
| 23-24        | 0.770**      | 0.006     | 0.552    | 0.078     | 0.900**  | 0.000     |
| 25-26        | 0.207        | 0.460     | -0.020   | 0.944     | 0.103    | 0.716     |
| 27-28        | 0.602        | 0.066     | 0.526    | 0.118     | 0.682*   | 0.030     |
| 29-30        | 0.537        | 0.072     | 0.646*   | 0.023     | 0.693*   | 0.012     |

r=correlation coefficient p=significant * p<0.05 **p<0.01

The age of lower second premolar and first molar with periapical radiographic analysis. The results of this study were obtained from the average chronological age and TCI values of 60 intact lower second premolar and first molar tooth samples in patients aged 21-30 years. The present study results proved that the CPCIM method can be used to estimate the dental age of lower second premolar and first molar in patients aged 21-30 years through periapical analysis. According to the study by Veera et al. (2014) it has been stated that age group of 21-30 years has a higher correlation with TCI compared to other higher age groups because of the secondary dentin formation due to advancing age. (Veera et al., 2014)

Previous studies reported the assessment of chronological and dental age based on panoramic radiography. (Godge et al., 2014; Yunus and Wardhani, 2016)

Meanwhile, the estimation of dental age can be identified using CPCIM method, which is calculated through the correlation between the reduction of the coronal pulp cavity and the chronological age. Lower premolars and molars were considered in this method, as the mandibular teeth are more visible than the maxillary ones. (Priyadarshini et al., 2015; Putri et al., 2013)

The youngest sample of this study aged 21 years and the oldest age of the group is 30 years with the proportion of male and female is the same 50% (n = 30) as described in Tables 1 and 2. The data of the sample is analyzed using paired t test. In Table 3 the p value = 0.0119 and in Table 4, the value of p = 0.224. Pearson correlation was used to find out the correlation between chronological age and TCI. Table 5 shows a positive correlation between age and TCI at the age group of 21-22 years, 23-24 years and also showing a higher significant correlation on lower second premolar compared to first molar. The results from above statistics proved that CPCIM can be used as a tool for the prediction of the age.

CONCLUSIONS

CPCIM method can be used to estimate the dental age on healthy lower second premolar and first molar.

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