



Estimation of Dental Age Using Coronal Pulp Cavity Index (CPCI) on Lower Second Premolar and First Molar with Periapical Radiographic Analysis

Trelia Boel^{*1}, Dewi Kartika¹, Ervina Sofyanti², Dennis³, Navanitha Naidu¹

¹Departments of Dental Radiography, Faculty of Dentistry, Universitas Sumatera Utara, Medan-Indonesia

²Department of Orthodontics, Faculty of Dentistry, Universitas Sumatera Utara, Medan-Indonesia

³Department of Conservative Dentistry, Faculty of Dentistry, Universitas Sumatera Utara, Medan-Indonesia

Article History:

Received on: 13 Dec 2019

Revised on: 10 Apr 2020

Accepted on: 15 Apr 2020

Keywords:

Estimation of dental age,
Periapical radiographs

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 $TCI = [CPCL \times 100] / CL$. 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.



*Corresponding Author

Name: Trelia Boel

Phone:

Email: trelia.boel@usu.ac.id

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i2.2171>

Production and Hosted by

IJRPS | www.ijrps.com

© 2020 | All rights reserved.

INTRODUCTION

Forensic odontology is a branch of forensic medicine with the proper handling and examination of den-

tal 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). Morsi *et al.* (2015) studied the accuracy of age estimation from TCI of mandibular premolars and molars using panoramic radiographs to develop regression equations that can be used in the Egyptians (Morsi *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. (Priyadharsini *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 soci-

ety, 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 (Morsi 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 radiograph, 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 a 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 pre-

cision 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 $TCI = [CPCH \times 100]/CH$.

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.

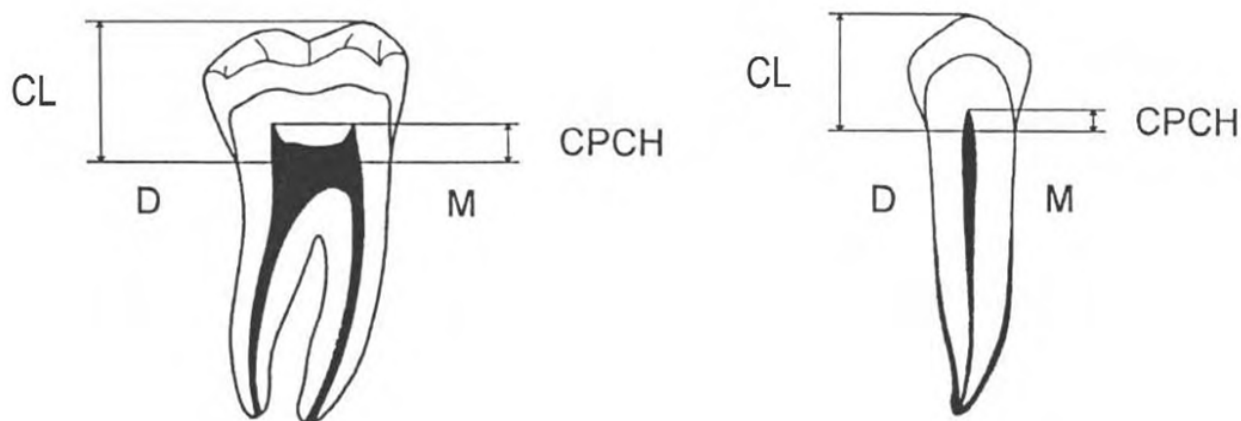


Figure 1: Schematic representation of measurements taken for Coronal Pulp Cavity Index (CPCI)

Table 1: Distribution of tooth sample according to sex

Lower second premolar/ first molar				
Male		Female		
N	%	N	%	
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	2 nd Premolar		1 st 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

DISCUSSION

This study was conducted to determine whether the CPCI method can be used to estimate the dental 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 CPCI 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 CPCI 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 CPCI can be

used as a tool for the prediction of the age.

[Morsi et al. \(2015\)](#) demonstrated the accuracy of dental age estimation from TCI of mandibular premolars and molars of using digital panoramic radiographs are precise, non-invasive, not time consuming, not required highly specialised equipment. [Priyadharsini et al. \(2015\)](#) The study by [Drusini \(2008\)](#) reported CPCI as a method that can be easily used to estimate age both in living individuals and skeletal material of unknown age in a forensic context. ([Drusini, 2008](#)) The above studies have proved that the digital radiographic techniques are used to estimate the dental age because it is a simple tool to view and measure the reduction in the pulp chamber.

The current study also proved that the CPCI method was used for estimation of dental age using periapical radiographic analysis because it could view the crown and pulp chambers accurately on lower premolar and first molar through periapical radiographic analysis. This study also explains the importance of CPCI method in the field of Forensic Dentistry. In the presence of such disasters, CPCI method can be used to identify victims. In addition, this method can also be used to estimate age as evidence in some criminal problems. Dental practitioners can consider CPCI method as a tool to determine the age of individuals in forensic cases.

CONCLUSIONS

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

ACKNOWLEDGEMENT

The authors are very grateful to all participants. This study was funded by Talenta Research University of Sumatera Utara, 2019, according to number 4167/UN5.1.R/PPM/2019.

REFERENCES

- Afify, M. M. 2014. Age Estimation from Pulp/Tooth Area Ratio in Three Mandibular Teeth by Panoramic Radiographs: Study of an Egyptian Sample. *Journal of Forensic Research*, 05(03).
- Badar, S., Khan, F. R., Hameed, M. 2016. Age Estimation of a Sample of Pakistani Population Using Coronal Pulp Cavity Index in Molars and Premolars on Orthopantomogram. *J Pak Med Assoc*, 66(10):39-41.
- Burhan, A. S., Nawaya, F. R. 2016. Use of the Tooth Coronal Pulp Index for Recognition of the Pubertal Growth Period. *The Journal of Contemporary Dental Practice*, 17(11):884-889.
- Chandramala, R. 2012. Application of Kvaal's Technique of Age Estimation on Digital Panoramic Radiographs. *Dentistry*, 02(06):2-2.
- Drusini, A. G. 2008. The Coronal Pulp Cavity Index: A Forensic Tool for Age Determination in Human Adults. *Cuadernos de Medicina Forense*, (53-54):53-54.
- Godge, P., Sharma, S., Vibhakar, P., Kulकर्नी, S. S. J. 2014. Age Estimation Using Orthopantomographs- A Forensic Study. *IJOCR*, 2(6):26-30.
- Indira, A. P., Shashikala, R., Nagaraj, T., Santosh, H. N. 2015. Age estimation of adults using dental pulp: A cross-sectional radiographic study. *Journal of Advanced Clinical & Research Insights*, 2:131-134.
- Mehta, S., Urala, A., R, V., Mehta, A., Lodha, S. 2017. Assessment of age with mandibular first molar: An orthopantomogram study. *Dental and Medical Problems*, 54:179-182.
- Morsi, D. E., Rezk, H., Aziza, A., El-Sherbiny, M. 2015. Tooth Coronal Pulp Index as a Tool for Age Estimation in Egyptian Population. *Journal of Forensic Science & Criminology*, 3(2).
- Priyadarshini, C., Puranik, M. P., Uma, S. R. 2015. Dental Age Estimation Methods: A Review. *International Journal of Advanced Health Sciences April*, 1:19-19.
- Priyadharsini, C., Masthan, K. M. K., Balachander, N., Babu, N. A., Jimson, S. 2015. Evolution of forensic odontology: An overview. *Journal of Pharmacy and Bioallied Sciences*, 7(5):178-178.
- Putri, A. S., Nehemia, B., Soedarsono, N. 2013. Prakira anusia individu melalui pemeriksaan giuntuk kepentingan an foren sikke dok terangi. *62(3):55-63*.
- Sakhdari, S., Mehralizadeh, S., Zolfaghari, M., Madadi, M. 2015. Age Estimation from Pulp/Tooth Area Ratio Using Dental Panoramic Radiography. *Journal of Islamic Dental Association of Iran*, 2:19-23.
- Veera, S. D., Kannabiran, J., Suratkal, N., Chidananda, D. B., Gujjar, K. R., Goli, S. 2014. Coronal pulp biomarker: A lesser known age estimation modality. *Journal of Indian Academy of Oral Medicine and Radiology*, 26(4):398-398.
- Yunus, B., Wardhani, Y. 2016. Differences chronological age and dental age using Demirjian method based upon a study radiology using radiography panoramic at the Dental Hospital Hasanuddin University. *Journal of Dentomaxillofacial Science*, 1(2):103-103. ISSN: 2503-0817.