

AGE ESTIMATION USING CEMENTUM - A REVIEW

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ABSTRACT

Cementum is a surface layer which is seen below the radicular dentin. It is near to the neck region of the tooth and thick at the root apex. It is formed by the cells known as cementoblast. Cementum helps the tooth to be attached to the periodontal ligament and alveolar bone through the Sharpey's fibre. Cementum helps in the repair and regeneration of damaged teeth. It has a high anti-absorption capacity. Age estimation using cementum technique is reliable to the teeth which is not affected by periodontal disease. Combined method of biological age estimation had high correlation when compared to public symphysis morphology and similar error were found among both the methods. The literature search on age estimation using cementum as carried out for papers published from Google Scholar and PubMed with the intention of retrieving all original reports that were relevant to it. This review helps to provide deeper understanding about age estimation using cementum which benefits the dentist and forensic department.

KEYWORDS: Age estimation, Cementum annulations, Cementum thickness

INTRODUCTION

Cementum is a surface layer present in the teeth which is seen below the dentin in the root area. It is thin at the middle region of the tooth and thick at the apex region of the teeth. Cementoblasts form this layer. It helps the tooth stick to the periodontal ligament and it also helps to attach to the alveolar bone. It is also helpful in the regeneration of damaged teeth. It has the tendency to inhibit absorption. It is a mineralized hard tissue present in the tooth (Pinchi *et al.*, 2007). Age estimation using layers of the teeth is one of the reliable forms of method to estimate the age of an individual (Dias *et al.*, 2010). The age estimation done by using cementum is a better method to obtain positive result value which gives estimated value near to the actual value (Rai *et al.*, 2008). Counting of the incremental lines in the cementum is another method for the age estimation which is done by using various instruments (Zander and Hurzeler, 1958). Apart from using the cementum for the age estimation the secondary dentin could also be used for estimating the age of an individual (Ten Cate *et al.*, 1977).

From the previous article, tooth cementum annulation is a microscopic study, it was based on the acellular fibres present within them (Radovic, 2012). The incremental line in the teeth can be numbered by using various types of colouring stains that helps us to see the incremental lines separately under the microscope (Renz and Radlanski, 2006). Among all the teeth in the mouth premolar teeth is the most reliable for estimation of age (Renz *et al.*, 1997). Incremental lines vary from place to place in the teeth (Phillips *et al.*, 1982). In few research, the researchers found that Para radicular cementum shows relation between actual age and estimated age (Stein and Corcoran, 1994). Hence, the aim of this review was to elaborate about the age estimation using cementum by its thickness and its cementum annulation.

METHODOLOGY

The literature search on the age estimation using cementum was carried out for the scientific article published from 1990-2020 using a database Google Scholar and Pubmed Intended purpose to recover all original reports related to the purpose and objectives of the review. The keywords used, age estimating method, cementum annulation and thickness of cementum, factors affecting the cementum, search of the reference list from relevant review articles were also employed to identify further relevant study. Hand searching of reference lists are selected articles also carried out. The level of evidence of the reviewed article was categorised as per the criteria of the Centre for Evidence-Based Medicine, Oxford, Uk ([CEBM, 2011](#)).

Determining age using cementum

As the age increases the cementum in the place of the Cementoenamel junction shows movement in the coronal region and their thickness gets increased at the apical region ([Raju et al., 2016](#)). Changes can be seen in the impacted teeth which can be due to the force during eruption period and it also affects the program present in Cementoenamel junction ([Bocutoğlu and Yakan, 1997](#)).

BR regression equation for age estimation using cementum

Regression equation is a statistical method used to estimate the age using the known actual age. The procedure for this method is followed by measuring the distance between the enamel and cementum using micrometer values are obtained this done in the ground section of the tooth in the mandible, after obtaining the values Regression equation is used, but the outcome value (age) was less when compared to the known age ([Rai and Anand, 2009](#)). While proceeding with this method few status of the tooth should be considered such as nutrition ([Rai, 2009b](#)). The displacement of cementum in the coronal region can be helpful to represent the age ([Rai, 2009a](#)).

Polarised light and stereo microscope for age estimation using g cementum

In this method, the stained and unstained ground sectioned of the teeth is used which is helpful to measure the thickness and annulation present in the cementum and these two are viewed by using using polarised light which is attached with the stereo microscope and then result where generated from the results we can see the moderate values which are almost close to known age using this method 1% of cases we can get correct of age ([Kasetty et al., 2010](#)).

Comparison of various age estimation methods of dentistry

Among various age estimating particularly few age estimation methods are considered in the field of dentistry they are Lamendin *et al* method, Bang and Ramm method and tooth cementum annulation method. Among these three, Lamendin *et al* methods and Bang and Ramm methods were showing high error values. But when comparing with the previous two methods tooth cementum annulation gave moderate value ([Meinl et al., 2008](#)).

DISCUSSION

The new methods were developed using computer technologies by developing a software which scans the layer in the tooth one by one and gray scale peaks are counted in a particular region. In this method, Fourier analysis and algorithm methods are used to obtain value, the estimation of age reproduced with the accurate value. This method excludes the human error such as fatigue ([Czermak et al., 2006](#)). Cementum annulation is used for age estimation; this cementum is clearly visible under contrast microscope >polarized microscope >light microscope ([Kaur et al., 2015](#)). Age estimation using cementum can give a result which may have error not more than 2.5 years and hence, this result is reliable when compared to other methods ([Wittwer-Backofen et al., 2004](#)).

There are many methods available for the age estimation, olzes method is most recently invented for the estimation of age which is used in dentistry. In this method, the estimated age obtained is close to the actual age (Palati *et al.*, 2019). Maxillary central incisors are useful in the age estimation and at the same time we can determine the gender (Abitha and Santhanam, 2019). Hypomineralization of the tooth makes age estimation a more complicated process (Sheriff *et al.*, 2018; Sukumaran and Padavala, 2018). During the estimation of age physical height is important for the ground sectioning the tooth (Harrita and Santhanam, 2019).

In some cases the age estimation using cementum becomes complicated Whenever a layer (enamel and cementum) of the teeth is eroded by the aging process or by the microbial action the patient feels sensitivity in the teeth (Gunasekaran and Abilasha, 2016). This can be observed using dental photography which is more important. They are the records for the dentist to identify the level of damage to the internal and external portion of the teeth (Hannah *et al.*, 2018). It also maintenance of the Heath discipline is important among the clinical students while treating a patient (Ahad and Gheena, 2016; Prasanna and Gheena, 2016). The teeth are affected mostly due to the microbial reaction which occurs due to the variation occurring in the climate and variation intake of food, this can lead to the oral lesions in the old people (Palati *et al.*, 2020) (Manohar and Abilasha, 2019). If the medical negligence occurs (Uma *et al.*, 2020). The diagnosis of damaged specimens can lead to highly level risky consequences of treatment (Krishnan *et al.*, 2018), some microbes can also cause the oral squamous carcinoma (Shree *et al.*, 2019). Oral biopsy plays an important role in dentistry which helps them to identify the oral lesions (Sheriff *et al.*, 2018). Due to various microbial actions the layers of the tooth get damaged which lead to complications during the age estimation process, the microbial action can be due to the environmental changes (Sarbeen *et al.*, 2016). The most important thing in dentistry is to maintain the health discipline is among the clinical students places a major role while treating a patient (Ahad and Gheena, 2016; Prasanna and Gheena, 2016).

The limitations in this review were collected retracted articles which ever used as reference relevant to the estimation of age using cementum thick and annulation.

Future study about this topic has to be reviewed for improved technology for large scale which can be detected using less cost effective sequencing approach the goal for developing different methods for calculating the age using cementum.

CONCLUSION

This review shows various methods for age estimation using cementum. This provides a deeper understanding of age estimation using cementum and it would be a source for dentist and forensic department researchers .

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

SundarR: literature search, data collection, analysis, manuscript writing, Gifrina Jayaraj: data verification, manuscript drafting, Gayathri: data verification, manuscript drafting.

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Table 1: Description of included studies

S.no	Author	Year	Type of study	Level of evidence	Key Points	Quality of the study
1	(Pinchi <i>et al.</i> , 2007)	2007	research article	level 3	The non calcified samples are not used in this method and thickness of cementum in radicle region id used for the age est	moderate

2	<u>(Dias et al., 2010)</u>	2010	research article	level 1	estimation of age using incremental lines without periodontal disease gives an mean error of 1.6 years and teeth with periodontal disease showed mean error of 22.6 years.	strong
3	<u>(Rai et al., 2008)</u>	2008	a preliminary study	level 2	From this study they have found that the female mandible has higher growth rate and method of age estimation using lateral cephalogram is medico-legal.	moderate
4	<u>(Zander and Hurzeler, 1958)</u>	1958	research article	level 3	Continuous deposition of cementum shows its vitality and it is due to the aging process.this is affected by periodontal disease	moderate
5	<u>(Ten Cate et al., 1977)</u>	1977	research article	level 1	As the age increases and blood supply to roots gets reduced and the colour of the root gets changed gradually by the layers deposition.	strong
6	<u>(Radovic, 2012)</u>	2012	research article	level 3	By using the method of cementum annulation we can determine the age of poor preservation of skeletal samples.	moderate
7	<u>(Renz and Radlanski, 2006)</u>	2006	research article	level 1	Number of incremental lines in the root cementum gets varying every time due to the annual rhythm by counting the incremental line we can get an accurate age of person.	strong
8	<u>(Renz et al., 1997)</u>	1997	case controlled study	level 2	When the ground section of cementum is seen in the normal microscope it shows various light and dark rings and number incremental lines can give the age of a dead individual..	moderate
9	<u>(Phillips et al., 1982)</u>	1982	research	level 2	Incremental lines in the cementum and dentin vary highly due to the chemical and structural alteration in the matrix	moderate

					of the impacted teeth.	
10	(<u>Stein and Corcoran, 1994</u>)	1994	research	level 3	estimating age using para radicular cementum because pearson's product moment has a coefficient value $r=0.93$ which was in between the predicted age and actual age of the person	moderate
11	(<u>Bocutoğlu and Yakan, 1997</u>)	1997	research	level 2	Cementum has a tendency to overlap the enamel which has relation with age and coronal displacement with the value of $r=0.69$.	moderate
12	(<u>Rai and Anand, 2009</u>)	2009	research	level 3	Distance between the edge of the enamel and dentin is measured in the Bucco-lingual ground section of the tooth and the value was obtained using a regression equation which was slightly varying when compared to actual age.	moderate
13	(<u>Rai, 2009a</u>)	2009	research	level 1	Age and coronal displacement of the cementum are related by the value $r=0.56$ and then the age is calculated by using the regression equation.	strong
14	(<u>Meinl et al., 2008</u>)	2008	research	level 2	When compared to the tooth cementum annulation method of age estimation the errors were high in the Bang and Ramm and Lamendin et al methods.	moderate