Coronal displacement of cementum: Correlation between age and coronal movement of cementum in impacted teeth

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Abstract
This study was conducted on 48 impacted and 51 erupted maxillary permanent canine teeth extracted from healthy patients aged 13-73 years. Longitudinal buccolingual ground sections were prepared. The distance between the edges of cementum and enamel in each specimen was measured with an eyepiece micrometer. A correlation test was applied between age and the distance between enamel and cementum measurements. In impacted teeth, depending on age, cementum had a tendency to overlap the enamel; there was a linear correlation between age and coronal displacement of cementum ($n-2=46$, $r=0.69$, distance ($\mu$m) = 21.7$^*$ age (years) -440, $p<0.001$). No correlation between age and coronal displacement was found in erupted teeth ($n-2=49$, $r=-0.23$, $p>0.05$). Results of the study indicated that the cementum in impacted teeth migrated coronally during the ageing process. This may be related to continually erupting forces which affect the impacted teeth and may be a mechanism by which the teeth are protected at the cemento-enamel junction (CEJ). This phenomenon could be used in forensic dentistry to determine age. The absence of correlation in erupted teeth could be attributed to the masking effects of extrinsic factors.

Key words: Ageing, cemento-enamel junction, cementum, impacted canines.

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Introduction
The three hard tissues of teeth: enamel, dentine, and cementum are apposed at the cemento-enamel junction region (CEJ). These tissues undergo structural changes throughout life, and there is continuous cementum apposition. The root dentine becomes sclerotic and glass-transparent and attrition occurs on the enamel.$^{1-6}$ Two major factors are found to be responsible for these changes: environmental effects and ageing.$^{7-9}$ Erupted teeth are directly affected by conditions such as mastication, toothbrushing, and by ageing. Impacted teeth remain intact and are only affected by the ageing process. Therefore, impacted teeth are considered suitable for use in researching the effect of ageing on teeth.$^{7-9}$ In order to establish whether or not the cementum was displaced coronally, the authors compared erupted with impacted teeth.

Cementum deposition on a healthy tooth continues throughout life – a relationship exists between age and cementum thickness. Between the ages of 11 and 70 years the average thickness of cementum increases threefold. This deposit is greater in the apical area than it is near the cemento-enamel junction.$^{1-4,7-10}$

So far as the authors could ascertain, no information was available in the literature regarding the effect of age on the coronal movement of cementum.

Materials and methods
In this study 99 extracted permanent canine teeth (48 impacted and 51 erupted) were used. Additional care was taken in the extraction procedure to minimize damage to the teeth; teeth which were damaged during extraction were excluded from the study. The teeth were obtained from healthy patients ranging in age between 13 and 73 years. The canines were rinsed in running tap water and were placed in a 10 per cent formaldehyde saline solution for one hour; longitudinal buccolingual ground sections were prepared from each specimen.

The gaps between the cementum and the enamel, or the amount of cementum overlapping the vestibular cervical region of the ground sections of
teeth, were measured by means of a micrometer inserted into the ocular of a light microscope.

All measurements were carried out as a blind study by the same investigator. The measurements were: zero when there was an edge to edge relationship between the enamel and the cementum; a minus value was assigned when there was a gap between them; and a positive value in the case of cementum overlap.

Tests were carried out to find whether there was any correlation between patient age and the cementum-enamel relationship.

**Results**

Table 1 contains the measured distance between the edges of enamel and cementum in the impacted teeth and the age of the patients in years.

Correlation was found between the age of the patient and cementum overlap ($n=46$, $r=0.69$, $p<0.001$) on impacted teeth. The regression line (distance ($\mu$m) = 21.7* age - 440) is shown in Fig. 1. However, no correlation was found in erupted teeth ($n=49$, $r=-0.23$, $p>0.05$) as shown in Fig. 2.

Figures 3a, 3b and 3c show the cemento-enamel junction regions of impacted upper maxillary canines obtained from patients aged 23, 50, and 73 years. These illustrations represent the tendency of cementum to overlap enamel as the patient ages. At the age of 73, the cementum overlaps the enamel by more than 2.5mm.

**Discussion**

The authors had perused the available dental literature but could not find any reference directly or indirectly related to coronal displacement of dental cementum. Thus, this report may be the first to document this displacement.

Dental cementum is a vital tissue which demonstrates continuous apposition throughout the life of the tooth. It is not equally distributed on the root surface. The thickness of cementum is greater on the apical areas while thinner near the cemento-enamel junction. Cementum appears to be independent of both the pulp and dentine for its nutritional requirements. A pulpless tooth still presents vital cementum, and there is a straightline correlation between age and cementum thickness in impacted teeth. Gottlieb suggested that continuous cementum apposition is necessary for maintaining a healthy periodontium. Cementum, like bone, is a labile tissue that reacts to stress and under certain circumstances can undergo resorption or hyperplasia.

This study shows that there is a significant linear and positive correlation between age and coronal displacement of cementum in impacted teeth. This could be attributed to continually eruptive forces which affect the impacted tooth, or that this

<table>
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<th>Descriptive statistics of cement-enamel distance ($\mu$m)</th>
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<tr>
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Fig. 1. – Distance between the edges of cementum and enamel measured in $\mu$m plotted against the age of the patient with estimated regression line for impacted canines. High linear positive correlation found ($n=46$, $r=0.69$, $p<0.001$ distance=21.7x age -440).

Fig. 2. – Distance between the edges of cementum and enamel is measured, then plotted against the age of the patient, with estimated regression line for erupted canines. There is no significant correlation. ($n=49$, $r=-0.23$ y= -30.69x -815 p=not significant.)
The cemento-enamel junction of human teeth has not been frequently studied, that is, its development, structural features, and other aspects are not fully understood. One of the ultimate goals of periodontal therapy is the regeneration of periodontal tissues lost due to periodontal diseases. Although there are more sophisticated methods to determine the cemento-enamel junction, the authors preferred to concentrate on the observation of ground sections of teeth. The advantages of this method are that the measurements may be carried out by an unskilled worker and that the results are reproducible. The experiments with ground sections which were carried out to determine measurements of distance, thickness, and so on produced more accurate results than with decalcified sections. Ground sections are dimensionally more stable than decalcified sections. To measure the distances, the authors used light microscopy rather than scanning electron microscopy.

Some observations indicated that the cementum might play a role in periodontal connective tissue formation by regulating the activity of cells. Recent studies on guided tissue regeneration in periodontal wound healing demonstrated that there was extensive periodontal tissue regeneration. As a result of the guided tissue regeneration process, new cementum formation also occurred.
In the light of the authors’ research, there is a potential for cementum to recover around the cemento-enamel junction. If contributing conditions could be avoided for a reasonable period of time, new cementum formation should be expected.

References

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