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Microscopic Analysis of The Variations of The Cemento-Enamel Junction in Himachali Population

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Abstract

Cemento-Enamel junction is an anatomical point where the enamel of the crown surface connects to the cementum of the root. It lies in a region covered with the gingivalsoft tissue, but with the increasing age and due to many pathological conditions this junction may be exposed to the external environment and sometimes may provide a path for bacterial infection into the tooth. Aim: To analyze different types of Cemento-Enamel Junctions in thepopulation of Himachal Pradesh. Methodology: 40 extracted teeth were obtained from various regions of Himachal Pradesh. Ground sections of the tooth were made and analyzed for the type of Cemento-Enamel Junction under a Binocular Microscope. Result: Sharp junction was most frequent type of inter-relation between the two hard tissues in our study followed by Gap junction and Overlap type junction. Though we found cementum overlapping enamel in few cases but we could notfind any sample in which enamel was overlapped by cementum. Conclusion: Cemento-Enamel Junction presents different morphological patterns so a study of this region is necessary to avoid complications during various dental procedures such as sensitivity after bleaching or cervical caries after placement of crown or clamps.

Keywords: Cementum, Enamel, CEJ, Premolars, Morphological patterns.

Introduction

Cemento–Enamel Junction is the anatomical boundary between enamel on tooth crown and the cement which covers the root of the tooth. (Franchischone 2006; Francischone & Consolaro, 2008).[1] The CEJ serves as an important point of reference in clinical dentistry, as it is usually the site where gingival fibers attach to a healthy tooth. It is the reference benchmark in order to assess periodontal destruction (Hu *et al*., 1983; Berendregt *et al*., 2009).[2]

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Analysis of the anatomy of the CEJ is helpful in explaining pathological processes that occur in this region, as well as for the identification of the biological phenomena involvedin the initiation of pathological processes, such as external cervical resorption.[3]

In young adults, the CEJ of permanent teeth is protected by the gingival tissues.Gingival fibers are annexed to the CEJ and thus contribute to the stability of the tooth; therefore, examining CEJ is a useful clinical parameter for determining periodontal disease.[4,2]However, with increasing age, as well as the effects of various physical and chemical agents continuous passive eruption, which compensates for wear at the incisal and occlusal surfaces along with the recession of the gingiva, results in a shift of the CEJ to the gingival sulcus. These changes expose the CEJ to the oral environment, thus making it vulnerable to

pathological changes such as root caries and cervical erosion, resorption, and abrasion.[4]Disturbance of the integrity in the cement or enamel may expose dentin around the tooth neck and cause hypersensitivity, caries or erosion.[4,1] In this research we suggest different forms of CEJ and its prevalence among the Himachli population

Material and method

40 permanent and healthy teeth were selected for the study.The study samples were obtained from a collection of premolars available at the Department of oral surgery as well as private clinics of Himachal Pradesh. The teeth had been extracted for orthodontic reasons or prosthetic reasons from people of both genders with an age range of 16 to 35 years. Non carious, non-restored Mandibular premolars from both genders were included for the study. Teeth with morphological/developmental abnormalities, caries, fracture/trauma, or erosions/attrition, carious lesions, restorations, zone exposure by periodontal disease or gingival recession, which could expose CEJ to the oral environment, were excluded from the study.

On obtaining the sample, each extracted teeth was cleaned with gauze and physiological saline, removing the biological material present at the level of the area to be studied taking special care to avoid any damage to the cervical region, and then the teeth were stored in 10% formalin individually until the time of investigation.

For preparing the ground section each tooth was cut longitudinally in labio-lingual direction using a hard-tissue microtome (Leica, SP 1600, Germany). Then the selected sections were ground using grinding stones, until the required thickness of approximately 70 µm was achieved. The sections were then finished using polishing sheets (10 µm and 3 µm). The prepared sections were dehydrated by immersing them in ascending concentrations of alcohol, after which they were mounted on glass slides.

Recording the data: The ground sections were observed at the cervical regions under ×10 magnification using an Olympus transmitted light microscope to establish the relationship of the mineralized tissues composing the Cemento Enamel Junction

The relationship of the mineralized tissues composing the CEJ was recorded and classified into four categories:

a. Cement covering enamel.
b. Enamel covering cement.
c. Edge-to-edge contact of cementum and enamel.
d. Gap between enamel and cementum.

Results

A sample consisting of 40 permanent premolars was for the study. Variations in the relationship of cementum to enamel were observed that included: Edge-to edge relationship of enamel and cementum, gap between enamel and cementum, and cementum over enamel. The variation between the inter-relationships of these two mineralized hard tissues has been summed up in Table I.Greatest number of occurrence was observed for the sharp junction (Fig.1) followed by Gap junction (Fig 2) and overlap type. In the overlap type, cementum overlapping the enamel (Fig.3) was seen in few cases but we could not find a case in which enamel overlapped cementum.

Table I: The frequency of interrelationship of enamel and cementum at the CEJ

Type of Cemento Enamel Junction	Frequency	Total Samples	Percentage
Sharp Junction	23	40	57.5%
Gap Junction	11	40	27.5%
Cementum Overlapping enamel	6	40	15%
Enamel overlapping Cementum	0	40	0%

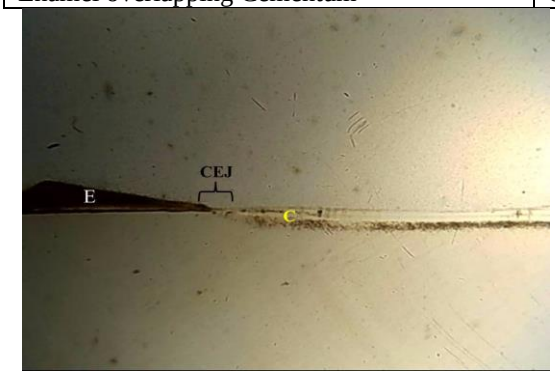

Figure I: Sharp Junction (C-Cementum, E-Enamel)

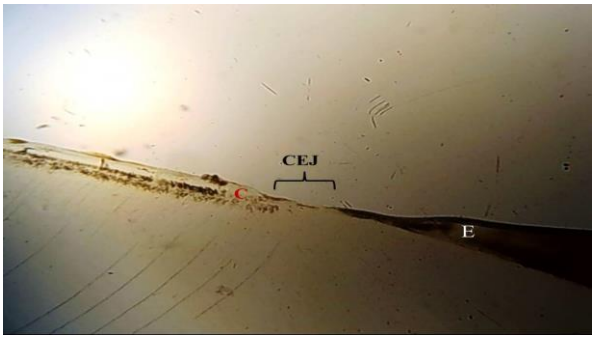

Figure II: Gap Junction (C-Cementum, E-Enamel)

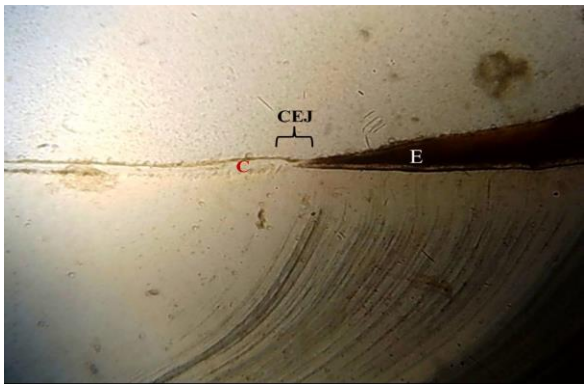

Figure III: Overlap Junction, Cementum overlapping Enamel (C-Cementum, E-Enamel)

Discussion

The morphology of the cemento-enamel junction of permanent teeth is becoming an area of great clinical significance due to itsassociation with dentin sensitivity and the susceptibilityof the cemento-enamel junctionto pathological changes, such as root surfacecaries and cervical erosion, resorption, and abrasion.[4]Vandana& Gupta (2009) indicate that one of the most important parameters in the evaluation of the periodontal disease is the loss of connective attachment to the tooth, and is here in the cemento-enamel junction, which is a static benchmark, acts to measure periodontal destruction.[2]Research suggests an interrelation between the type of junction and dentin permeability, especially when there is band of exposed dentin between the cementum and the enamel.

Cement-enamel border has been studied using a variety of methods such as microscopy,[4]scanning electron microscopy,[3]morphogens and embryonicanalysis.[6,7] Since Choquet[8] in 1899 first described the four mutual relationships between the cement and enamel in Cemento-Enamel Junction region, all of these methods were used for the classification, which includes the following relationships: 1. The cement overlaps the enamel, 2. The enamel overlaps the cement, 3. The enamel and cement abut each other with no overlap, and 4. There is a space between the enamel and cement, with exposed dentin in-between. Cemento-Enamel Junction morphology in permanent teeth has become an area of great clinical interest, because of its sensitivity and increased susceptibility of the dentin in the Cemento-Enamel Junction to pathological changes, such as radicular caries and non-carious lesions (Aw *et al.*, 2002).[9]

In young adults, the Cemento-Enamel Junctionof permanent teeth is covered by gingival tissues. However,with increasing age, continuous passive tooth eruption,which compensates for wear at the incisal and occlusalaspects, exposes the Cemento-Enamel Junction to the oral environment.[4] Furthermore, in addition to diverse chemical and physical factors present in the oral environment, improper brushing of teeth may disturb the morphology of Cemento-Enamel Junction causing the exposure of dentin.[4]Cemento-Enamel Junction is a zone that in contact with the oral environment becomes susceptible to morphological changes, induced by physical agents, such as, traumatic tooth brushing and dental Instruments (curettes, jackets and clamps).[3]The above observations indicate that there is considerablemorphological diversity at the Cemento-Enamel Junction, both for any tooth typeand for any individual tooth of a given type.[4]

In the present study, light microscopes were used to analyze the ground sections of teeth. However the study had limitations as we were able to analyze only two points rather than the whole length of cementum. We found the edge to edge contact (57.5%) as the most prominent relation between the two hard tissues followed by the gap junction (27.5%) and the overlap type (15%). Our findings were in accordance to the study done byBevenius et al.[10] found that edge-to-edge contact of enamel and cementum was predominant (76%)[4]The type of interface with enamel over the cementum was not found in our case.The rare occurrence of a fourth type of tissue interrelationship, i.e., enamel over cementum, is difficult to explain from an embryological standpoint, because cementum formation begins after enamel formation is completed. Muller and van Wyk[11] regarded this novel morphology as an optical illusion that arose due to the thickness of ground sections; however, Ceppiet al.[12] and Neuvald and Consolaro[3] reported a similar morphology in their SEM investigation of primary and permanent teeth.[4]

Conclusion

It can be concluded from the study that the two hard dental structures are present in various morphological patterns and as the Cemento-Enamel Junction is a zone predisposed to the development of pathological changes during various clinical procedures that include placement of clamps, stainless steel crowns, clamps, restorative materials and dental bleaching,the study of this region is important so as to avoid further complications such as the progression of dental caries from the cervical region or the dentinal hypersensitivity

due to exposure of the dentinal tubules as can be seen in the gap junction.

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