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Review Article

Histology of human cementum: Its structure, function, and development



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Human cementum

Summary Cementum was first demonstrated by microscopy, about 180 years ago. Since then the biology of cementum has been investigated by the most advanced techniques and equipment at that time in various fields of dental sciences. A great deal of data on cementum histology have been accumulated. These data have been obtained from not only human, but also non-human animals, in particular, rodents such as the mouse and rat. Although many dental histologists have reviewed histology of human cementum, some descriptions are questionable, probably due to incorrect comparison of human and rodent cementum. This review was designed to introduce current histology of human cementum, *i.e.* its structure, function, and development and to re-examine the most questionable and controversial conclusions made in previous reports. © 2016 Japanese Association for Dental Science. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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1. Introduction

Cementum, or root cementum, is a mineralized tissue covering the entire root surface. According to Denton [1], cementum was first demonstrated microscopically by Fraenkel and Raschkow (1835) and Retzius (1836), and has since become a part of general knowledge in dentistry. Cementum exists fundamentally in mammalian teeth, which fit into alveolar sockets of alveolar bone, and functions as a tooth-supporting device in concert with the periodontal principal fibers and alveolar bone. The cementum covering the enamel surface also exists in several non-human animals such as the horse, sheep, rabbit and guinea pig. This type of cementum is termed “coronal cementum” and distinct from root cementum. Cementum is often referred to as a bone-like tissue. Cementum, however, is avascular, does not undergo dynamic remodeling, and increases in thickness throughout life. On these points, cementum is markedly different from bone.

Knowledge of cementum histology has been accumulated with the advancement of investigating techniques and equipment. Most of the data, however, have been obtained from rodents such as the mouse and rat. Hence, previous reports on histology of human cementum have contained some questionable descriptions, probably due to incorrect comparison of human and rodent cementum. The purpose of this review is to introduce current histology of human cementum and to re-examine the most questionable and controversial conclusions made in previous reports.

2. Classification of cementum

Cementum has historically been classified into cellular and acellular cementum by inclusion or non-inclusion of cementocytes. Generally, acellular cementum is thin and covers the cervical root, whereas thick cellular cementum covers the apical root (Fig. 1). Cementum contains two types of fibers, *i.e.* extrinsic (Sharpey's) fibers which are embedded ends of the principal fibers and intrinsic fibers which are fibers of cementum proper. It is believed that the extrinsic fibers are secreted by fibroblasts and partly cementoblasts and that the intrinsic fibers are secreted by only cementoblasts. Jones [2] added these fibers to items of cementum classification, and Schroeder [3] established the current classification, which is now widely used in the dental field. In accordance with this classification, three major types of cementum are distinguishable [2–5]. “Acellular

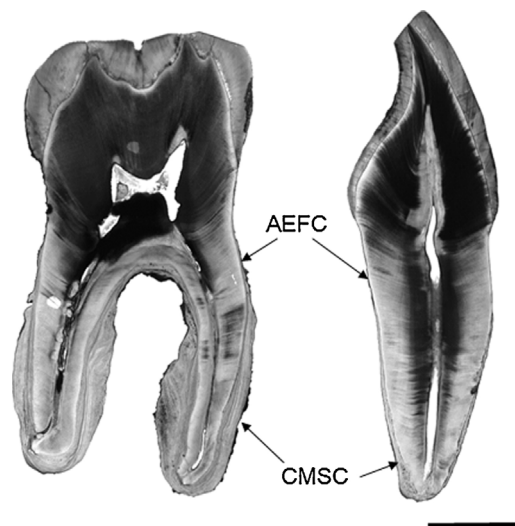


Figure 1 Full view of a mandibular molar (left) and a maxillary incisor (right). Thin AEFC and thick CMSC cover cervical and apical roots, respectively. CMSC is much thicker in the molar than in the incisor. Hematoxylin-stained ground section. Bar 5 mm.

extrinsic fiber cementum (AEFC)” contains densely packed extrinsic fibers and no cementocytes (Fig. 2). AEFC corresponds to classical acellular cementum. “Cellular intrinsic fiber cementum (CIFC)” contains intrinsic fibers and cementocytes. “Cellular mixed stratified cementum (CMSC)” corresponds to classical cellular cementum. Typical CMSC is partitioned by intensely hematoxylin-stainable lines or incremental lines. The individual partitioned cementum is CIFC, and occasionally AEFC (Fig. 3A–D). Namely, CMSC represents the whole of cellular cementum composed of stratified CIFC and AEFC. Cellular cementum with both intrinsic and extrinsic fibers is often found within CMSC (Fig. 3D). This type of cementum is not distinctively classified and is regarded as a sub-variety of CIFC in the current classification [5]. This review will deal with the three major types.

3. Structure of cementum

3.1. Acellular extrinsic fiber cementum (AEFC)

Generally, AEFC covers cervical root surfaces in both permanent and deciduous teeth. The covering range is different

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