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Review Article

Implications of Lamina Dura in Dental Radiology: An Overview

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Abstract

Lamina Dura otherwise known as a hard layer is a debatable question, on its significance and implication in various conditions. According to some Dentists if there is a complete or partial absence of Lamina dura then it is a diagnosis of pathoses like Cushing syndrome, Osteoporosis, Leukemia Pyle's disease, Hyperparathyroidism, and some other periapical pathology. While others suggest that the radiographic increase in density of the Lamina dura indicates Osteopetrosis, Hypercementosis, and Occlusal traumatism. While endowing any diagnosis and treatment of any local or systemic disorders, the dentist is wherefore advised to consider other signs and symptoms, in conjunction with the integrity of the lamina dura. Lamina Dura delineates the tooth socket and is made up of a thin layer of compact bone. In a dental arch, a radiograph of healthy teeth demonstrates that the tooth socket is compassed by a thin radiopaque layer of dense bone. So, this article mainly accentuates the significance of lamina dura in health and disease.

Keywords: Lamina Dura; Hard Layer; Diagnostic Landmark; Compact Bone

Introduction

The aim to live free of diseases is everyone's dream and struggle in reality. For the detection of osseous abnormalities in the maxillary and mandible region radiographs are the accurate and least subjective diagnostic aid available. To evaluate changes in bone patterns density and grayscale changes in radiographs are important features that the clinician uses. As new techniques and concepts arise radiographic diagnostic accuracy indeed evolves and changes. Lamina dura is made up of a thin layer of dense bone that lines the socket. Radiographically, it is seen as a thin white radiopaque line around the roots of the tooth and below the crest of the alveolar bone. Lamina dura was also said to have a direct relationship with occlusal trauma. In 1953, Richey and Orban concluded that Lamina Dura indicated changes in periodontal disease and health [1]. Manson, in 1963, thought that the LD was just a radiographic artifact; a tangential bony radiopacity that has no clinical significance and is inconsistent with disease or trauma, or periodontal health [2]. The classic literature describes that radiopaque socket of Lamina Dura as an image of a lining-reactive bundle of bone where external forces applied to its surface by Sharpey's fibers. Greenstein concluded that the LD was not related to the presence or absence of any clinical inflammation [3,4].

Anatomical importance

During development the lamina dura is an extension of the lining of the bony crypt that surrounds each tooth. Its mineralization component is similar to the trabeculae of cancellous bone in the area [1]. The presence of an intact lamina dura around the apex of a tooth suggests a vital pulp in that region. In the detection of early periapical pathological processes, periodontal diseases, and other

disorders in which lamina dura is found to be lost the integrity of lamina dura is important. The absence of LD does not always results in an apical pathology. The absence of LD may be because of overexposure to the film, or thin cortical bone/lining of the socket which will make it less distinct. In differentiating an odontogenic lesion from a nonodontogenic lesion this tiny structure plays an important role [5].

Radiographic appearance

Due to its radiographic appearance its name lamina dura (hard layer) is derived. The X-ray beam passes tangentially many times through the thickness of the thin bony wall which results in its observed attenuation and gives its appearance. At the alveolar crest this layer is continuous with the shadow of cortical bone [6].

Double lamina dura

If the mesial or distal surface of the root is present to elevation in the path of x-ray beam the image of double lamina dura is not uncommon. For e.g., Double lamina dura is seen on the mesial surface of mandibular first molar roots [6].

Normal variations and confusing shadows [6]

Projection over the maxillary sinus, Tooth rotation, Apex of maxillary canine (canine fossa), Maxillary premolars before maturation, Tongue out of roof of the mouth during panoramic, Projection over the mental foramen, Projection over the mandibular canal.

Accentuation of Lamina Dura [6]

- Normal variant
- Disease of skin: Scleroderma (systemic sclerosis)

Common pathological conditions affecting lamina dura [7]

Periapical pathosis (periapical abscess, periapical granuloma, radicular cyst), Fibrous dysplasia, Paget's disease of bone), Metabolic disease (Osteoporosis, osteomalacia), Blood disorders (Leukemia), Sclerosing osteomyelitis, Idiopathic, Fibro-osseous disease.

Uncommon pathological conditions affecting lamina dura [7]

Benign lesions of jaw like periapical cement osseous dysplasia, Traumatic bone cyst, Metastatic malignancy (especially breast), Langerhans cell Histiocytosis, Diseases of bone: Hypoparathyroidism, Systemic disease: Renal tubular acidosis, Oxalosis, Disease of blood: Thalassemia, Metabolic diseases: Osteomalacia, Rickets (including vitamin D resistant form), Acromegaly, Hypervitaminosis D, Hypovitaminosis C, Hyperphosphatasia, Cushing's syndrome, Disease of skin: Scleroderma (systemic sclerosis), Other rare conditions like Fibrous histiocytoma, Noma, Postmenopausal osteoporosis, Anaemia and Steroid medications, Removal of opposing tooth, Sickle cell disease, Tumors: Multiple myeloma, Burkitt's lymphoma.

Partial loss of lamina dura in benign conditions [7]

Traumatic bone cyst, Keratocystic odontogenic tumor, Lateral periodontal cyst, Ameloblastoma, Periapical abscess, Periapical cyst, Cushing syndrome, Root resorption, Periapical granuloma, Simple bone cyst.

Partial loss of lamina dura in malignant conditions [7]

Fibrous Dysplasia, Central giant cell granuloma, Burkitt lymphoma Metastatic tumor, Periapical cemental osseous dysplasia, Fibrosarcoma, Multiple myeloma, Leukemia.

Complete loss of lamina dura seen in following conditions [7,8]

Agranulocytosis, Hypochromic anemia. Hypophosphatasia and Paget's disease Hyperparathyroidism, Renal osteodystrophy, Hypophosphatasia.

Variations of the lamina dura shadow

Not only around different teeth in the same mouth but in a single tooth wide variations in the thickness of the lamina dura are seen. As a result of differences in the shape and contour of the different roots or root variation is seen in the width and density of the lamina dura shadow. With the amount of occlusal stress to which the tooth is related the thickness and density of lamina dura on the radiograph vary. In heavy occlusion Lamina dura is wider and denser in the roots of teeth and in the roots that are not subjected to occlusal forces LD is thinner and less dense. It must be regarded as a normal variation in the absence of any change in the bone immediately adjacent to the lamina dura. As mentioned above, with a few exceptions, as in the case of upper cuspids, lack of continuity of the lamina dura indicates abnormality (infection of the bone). Even very small discontinuity has significance.

The presence of intact lamina dura around the apex of the tooth strongly suggests a vital pulp. In which there has not been sufficient

time for the erosion of the lamina dura to occur acute peri-apical infection may occur occasionally. In some abnormal condition there is total or complete absence of lamina dura of all teeth. From the recognition of local oral changes Dentists often are the first to detect a serious general condition. The absence of all or nearly all, lamina dura shadows is usually evidence of general decalcification.

Effect of age on the appearance of lamina dura

After eruption through hard cortical bone covering the mandibular third molar the decline of the lamina dura correlates with age. The Severance of lamina dura increases with age independently with bone resorption in the canine and first molar region, suggesting that the lamina dura below the crown is not responsible for the alveolar bone resorption of other teeth in the mandible [9].

Effects on lamina dura in pregnancy

Marya., *et al.* conducted a study on pregnant females and concluded that the loss of lamina dura was probably because of gestational hyperparathyroidism and mild resorption of the lamina dura may be a feature of normal pregnancy [10].

Conclusion

The presence of intact lamina dura around the apex is a sign of vital pulp. However, the absence of its image around an apex on a radiograph may be normal. The presence of crestal and radicular lamina dura is of significant diagnostic value. The appearance of the lamina dura is a valuable diagnostic feature and any deviation is highly suggestive if not indicative of an abnormal condition. From recognition of local oral changes Dentists are often the first to detect a serious general condition. When establishing the diagnosis and the treatment of the local and systemic disorder the dentist is therefore advised to consider other signs and symptoms, as well as the integrity of the lamina dura. Along with the integrity of LD, the clinician must see other signs and symptoms before proceeding with a diagnosis and treatment planning.

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