

LAMINA DURA: DIAGNOSTIC LAYER ON RADIOGRAPH**Dr. Tanuja Vilasrao Mote^{1*} and Dr. Birangane R. S.²**¹Department of Oral Medicine and Radiology, Pandit Deendayal Upadhyay Dental College, 19/1, Kegaon, Solapur, Maharashtra, India.²Head of The Department of Oral Medicine and Radiology, Pandit Deendayal Upadhyay Dental College, 19/1, Kegaon, Solapur-413255, Maharashtra, India.***Corresponding Author: Dr. Tanuja Vilasrao Mote**

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ABSTRACT

Lamina dura is also known as the lining of the tooth socket made of a thin layer of dense bone and in some cases its significance is a controversial issue. According to some dentists, in cases of complete or partial loss of lamina dura, systemic conditions such as osteoporosis, hyperparathyroidism, Cushing's syndrome, Peyer's leukemia and some other periapical diseases can be detected. Others believe that a radiographic increase in dural density may indicate hypercementosis, osteopetrosis, or occlusal trauma. Dentists are therefore advised to study other signs and symptoms, including the integrity of the lamina dura, when diagnosing disease or infection. Therefore, this article mainly focuses on the importance of lamina dura in diagnostic purpose.

KEYWORDS: Lamina dura, hyperparathyroidism, osteoporosis.**INTRODUCTION**

The lamina dura is composed of a thin layer of dense bone that lines the tooth socket. Radiographically, it is seen as a thin white radiopaque line around the root of the tooth and below the apex of the alveolar bone [Fig No.1]. Important features that clinicians use to evaluate bone pattern density and gray scale changes in radiographs. Radiographic diagnostic accuracy actually evolves and changes as new techniques and concepts emerge. The lamina dura is also said to be directly related to occlusal trauma. In 1953, Rich and Orban concluded that the lamina dura reflects periodontal disease and changes in dental health.^[1] Manson, in 1963, thought that the lamina dura was merely a radiographic artifact; Bony radiopacity that has no clinical significance and is unpredictable with disease or trauma or periodontal health.^[2] In the classic literature the radiopaque socket of the lamina dura is described as an image of a bony lining-reactive bundle where external forces are applied to its surface by Sharpe's fibers.^[3,4]

**Fig. No. 1.****History of lamina dura**

Maury Musler [1945] studied the importance and structural characteristics of the lamina dura, the changes in its appearance during various kinds of tooth movement and in systemic disease.^[1] Frank E. Bubb [1949] proposed different factors in the repair of alveolar bone and cementum.^[5] Grace Patrikowsk [1995] attempted the radiographic differentiation of osteogenic sarcoma, osteomyelitis and fibrous dysplasia of the jaw and determined that the diagnosis could not be based on radiographic features alone, although some radiographic findings were more valuable than others.^[6] Domenico Ricucci et al [2006] recognized that periapical lesions cannot be diagnosed based on the occurrence or lack of a radiopaque lamina, but require histological examination of serial sections.^[7] Minoru Yamaoka et al [2010] underlined the association of bone formation with disruption of the lamina dura beneath the crown of partially impacted third molars.^[8]

Anatomical Significance

At the time of development the lamina dura is an extension of the bony crypt lining that surrounds each tooth. Its mineralization element is similar to the trabeculae of cancellous bone in this area.^[1] The occurrence of an intact lamina dura around the apex of the tooth indicates an important pulp in that area. The integrity of the lamina dura is significant in the detection of early periapical pathological processes, periodontal diseases and other conditions in which the lamina dura is

lost. Absence of lamina dura does not always result in apical pathology. Loss of lamina dura may be due to overexposure of the film or to a thin cortical bone lining of the socket that makes it less distinct. This minor structure plays an important role in differentiating odontogenic lesions from nonodontogenic lesions.^[9]

Radiographic arrival

A radiograph of a complete tooth in a normal dental arch shows that the tooth sockets are surrounded by a thin radio-opaque layer of dense bone. It is named lamina dura because of its radiographic appearance. The word "lamina" comes from the Latin word lamin, meaning layer/slice. However, its name is now used for the radiographic appearance. This layer is continuous with the cortical bone shadow on the alveolar crest.^[10] The X-ray beam passes through the thickness of the thin bony wall several times tangentially as a result of which it is observed and gives its radiopaque appearance. At the alveolar ridge this layer is continuous with the cortical bone shadow.^[11] [Fig No. 2].



Fig. No. 2.

Chevron's sign

The appearance of the lamina dura on radiographs may change when the X-ray beam is directed through a longer extension of the structure. The lamina dura appears radiopaque and well defined. However when the beam is directed more obliquely, the lamina dura appears more diffuse and cannot be discerned. In addition, small changes and interruptions in the continuity of the lamina dura may represent the superimposition of trabecular patterns and small nutrient canals passing from the mandibular bone to the periodontal ligament.^[12]

Double lamina dura

Imaging of double lamina dura is not uncommon if the mesial or distal surface of the root is high in the path of the x-ray beam. For example, a double lamina dura is commonly found on the mesial surface of the mandibular first molar root.^[11] [Fig No. 3].



Fig. No. 3.

Normal Variations and Confusing Shadows^[11]

1. Apex of maxillary canine (canine fossa) 2. Rotation of teeth 3. Maxillary premolars before maturity 4. Projection on maxillary sinus 5. Tongue from roof of mouth during panoramic 6. Projection on mandibular canal 7. Projection on mental foramen.

Articulation of the lamina dura^[11]

1. Normal type
2. Skin Disease: Scleroderma (Systemic Sclerosis).

Common pathological conditions affecting the lamina dura^[13]

1. Periapical pathosis (periapical cyst, periapical granuloma, radicular cyst, fibrous dysplasia, Paget's disease of bone),
2. Metabolic disease (osteoporosis, osteomalacia),
3. Blood disorders (leukemia), sclerosing osteomyelitis,
4. Idiopathic, 5. Fibro-osseous disease.

Uncommon pathological conditions affecting the lamina dura^[13]

1. Benign lesions of the jaw such as periapical cement-osseous dysplasia, traumatic bone cyst, metastatic malignancy (especially breast), Langerhans cell histiocytosis,
2. Bone diseases: hypoparathyroidism,
3. Disease of blood: Thalassemia,
4. Metabolic diseases: Osteomalacia, rickets (including in vitamin D resistant forms), acromegaly, hypervitaminosis D, hypovitaminosis C, hyperphosphatasia, Cushing's syndrome,
5. Skin disease: scleroderma (systemic sclerosis),
6. Tumors: multiple myeloma, Burkitt's lymphoma.
7. Other rare conditions such as fibrous histiocytoma, noma, postmenopause and postmenopause drugs, removal of opposing teeth, sickle cell disease.

Partial loss of lamina dura in benign conditions^[13]

1. Traumatic bone cyst
2. Keratocystic odontogenic tumor
3. Lateral periodontal cyst
4. Ameloblastoma
5. Periapical cyst
6. Periapical Abscess
7. Cushing's syndrome
8. Periapical granuloma
9. Simple bone cyst.

Partial loss of lamina dura in malignant conditions^[13]

1. Fibrous Dysplasia
2. Central giant cell granuloma
3. Burkitt lymphoma
4. Metastatic tumor
5. Periapical cemental osseous dysplasia
6. Fibrosarcoma
7. Multiple myeloma
8. Leukemia.

Complete loss of lamina dura seen in following conditions^[13,14]

1. Agranulocytosis
2. Hypochromic anemia
3. Hypophosphatasia
4. Paget's disease
5. Hyperparathyroidism
6. Renal osteodystrophy
7. Hypophosphatasia.

Variation of lamina dura shadow

Wide variation in lamina dura thickness is observed not only around different teeth in the same mouth but also within the same tooth. Variations in the shape and contour of different roots or also result from differences in root width and density. The lamina dura shadow varies with the amount of occlusal stress in which the tooth is placed relative to the thickness and density of the lamina dura on radiographs. In severe cases the lamina dura is wider and denser at the root of the tooth and in non-affected roots the lamina dura is thinner and less dense for occlusal forces. In the absence of any change in the bone adjacent to the lamina dura it should be considered a normal variation. As mentioned above, with some exceptions, such as in the case of the upper cuspid, lack of continuity indicates a lamina dura abnormality (bone infection). The occurrence of an intact lamina dura around the apex of the tooth strongly suggests a vital pulp. In which there is insufficient time for erosion of the lamina dura, acute peri-apical infection may occur intermittently. In some rare cases there is total or complete absence of the lamina dura of all teeth. Dentists often detect serious general conditions by recognizing localized oral changes. Absence of all, or nearly all, lamina dura shadows is usually evidence of normal decalcification.

Effect of age on the appearance of the lamina dura

Decline of the lamina dura correlates with age after eruption from the hard cortical bone covering the mandibular third molar. Separation of the lamina dura increases with age independently of bone resorption in the canine and first molar regions, suggesting that the lamina lies beneath the crown. Not responsible for dura. Alveolar bone resorption of other teeth in the mandible.^[15]

Effect on lamina dura in pregnancy

Maria., et al. conducted a study on pregnant women and concluded that loss of lamina dura was probably due to gestational hyperparathyroidism and mild loss of lamina dura, which may be a feature of normal pregnancy.^[16]

CONCLUSION

An indication is the presence of an intact lamina dura around the apex is vital pulp. However, the absence of his image around the apex, radiographs may be normal. The presence of cristae and radicular lamina dura is of significant diagnostic value. The lamina dura is a valuable diagnostic feature and any deviation is highly

suggestive if not indicative of an abnormal condition. Dentists are often the first to recognize local oral changes and find a serious general condition. When establishing a diagnosis and local and systemic disorders are treated by the dentist, So it is advisable to consider other signs and symptoms as well as the integrity of the lamina dura. The physician should look for other signs and symptoms before proceeding along with diagnosis and treatment planning.

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