

Scope of Periodontium in Forensic Science

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Abstract

Forensic odontology is the application of dental knowledge in forensic science in identification of victims during criminal justice. This article highlights the important role of gingiva and the surrounding periodontal structures in forensic field. Evidence can be collected only with proper documentation of the dental records. The importance of dental records plays a key role not only in identification but also in terms of dental malpractice or in insurance claim. Recent studies have established ante mortem and postmortem changes in gingival and periodontal tissues. Thus periodontitis has a scope in forensic odontology.

Key-words: Forensic odontology, Periodontitis, Age estimation, Dental records

Introduction

Forensic dentistry is a branch of forensic medicine dealing with evidences and marks left by teeth (as in identifying criminal suspects or the remains of a dead person). It is performed by a comparative evaluation of the ante mortem (missing person) and postmortem (dead person).

Periodontics is a branch; which deals with clinical science of disease in periodontium. It is utilized for identifying individuals through morphology and pathology of periodontal structures and age estimation studies. Periodontal disease factors are most important for periodontics. Case documentation and photographs are proved to be the most important evidence for forensic odontology. Dentistry plays a significant role in this process. To identify the victims of crime and disaster through dental records, dentists assist those officials involved in criminal investigation. Recently, the periodontitis identified the features of ante mortem and postmortem changes in gingival tissues. In future, periodontal structures would play a crucial role in forensic odontology. This article gives an update on the assessment of periodontal structures and its uses in forensic science.

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Gingiva

Cell death occurs by apoptosis, necrosis, or autolysis.¹ Time lapsed after death is important in crime cases. Cellular change that takes place in gingival tissues helps to estimate changes after death. These changes vary in individuals at cellular level. Histological examination of gingival tissue when observed at different time intervals within 10 hours after death cellular changes occurs, in both postmortem and ante-mortem reports.² Gingival cells analysis by quantitative cytomorphometric method, involves scraping of attached gingiva to assess age and gender related alterations in the nucleus and cytoplasm. Chromatin clumping, nuclear karyopyknosis, widened intercellular junction and loss of epithelium are some of the changes at microscopic level seen at different intervals of time after death. Oral premalignant and malignant lesions, pathologic smears have cytoplasmic ratio values which showed that attached gingiva can be used for human identification.¹

COLOUR

Normal color of gingiva is pink and in some cases with pigmentation. Pigmentation is most commonly seen on labial aspect of gingiva and highest at the incisors. Pathologic pigmentations could be in various conditions like Peutz-Jeghers syndrome, Addison's disease, oral melanoma and melanotic macule.

CONTOUR

In healthy individuals, the gingival margin has

scalloped margin. This scalloping contour depends on location of teeth, size of proximal contact, gingival embrasures and alignment of teeth. Contour can be altered in case of improperly constructed restorations, gingival pathologies, and improper prosthetic abutments. Stillmans cleft and McCall's festoons are changes in contour seen on canine premolar region and are usually associated with occlusal trauma.

Position

Gingival margin is located 1 mm above the level of cemento enamel junction (CEJ) or at the level of CEJ. Apical migration of marginal gingiva below CEJ which leads to exposure of root surface due to periodontal diseases is called gingival recession.³ The main etiology of recession is gingival inflammation and faulty tooth brushing. Secondary factors include anatomic, habits, iatrogenic and physiologic. Studies have proven that gingival recession varies in different races.⁴

Periodontal Ligament

Morphology of periodontal ligament as age advances.⁵ Average width of ligament space is documented as 0.2mm. Considerable variation occurs in various individuals. This space is decreased around teeth that are nonfunctional and increased in hyper functional teeth.³

Thickness

The thickness of PDL will be exactly connected to age and mesioclusal drifting of teeth. PDL ranges in width from 0.15 to 0.38mm and progressively decreases with age. Periodontal ligament thickness is directly proportional to root dimensions.⁷

Widening

Periodontal ligament widening is seen in Bisphosphate associated osteonecrosis of the jaws, progressive systemic sclerosis primary hyperparathyroidism.⁸

Lamina Dura And Alveolar Process

Height, contour, density of crestal bone, tori, exostoses, bone loss (horizontal/vertical) are the clinical parameters alveolar bone for establishing identify of the individuals. Height and density of crestal bone are important factors of periodontitis.⁹ Alveolar crest height loss in mandibular. The thickness and alveolar process width increase between the first premolar.¹⁰

Cementum

Cementum is a dynamic structure that gets deposited throughout life. Cementum annulations play a role in age estimation in males and females. During the formation of cementum the alternate light and dark bands are formed from alternate deposition of hyper mineralized extracellular matrix with less mineralized layers. These light and dark bands correspond to one year of an individual. These are counted on a pictomicrograph under microscopes.¹¹

Number of Incremental lines (n) = X/Y

Where,

X = Total width of dentinocementum junction surfaces

Y = Width of two adjacent incremental lines in cementum.

Dental cementum has opaque and translucent bands in winter (dormant) and summer (growth) seasons. Dental cementum increment analysis (DCIA) is used to specify the season of death.¹²

Significance of Implants in Forensic Odontology

Dental implants have a high melting point. when teeth is exposed to extreme heat, vaporization of pulp tissues occurs, leading to separation and disintegration of the tooth crown and root. Dental amalgam, composite resin and gold are the conventional restorative materials which may melt or distort in high temperature. Dental implants have a melting point above 1650 degree centigrade. Implants can sustain thermal insults which is an added advantage in identification of victims. Pre and post incineration of the laser etched batch number is also visible which depends on the depth of etching and presence of the oxidation layer on the implant surface.¹³

Software database is also available which stores information related to implant designs, Implant systems, clinical and radiographic images which aids in crime cases.

Dental Radiographs

Dental radiographs are easily available and serve as a vital clue for identification.¹⁴ Shape of the teeth and roots, teeth present, missing teeth, residual roots, supernumerary teeth, attrition abrasion, fractures, bone

resorption due to periodontal disease, bone pathology, dental caries, endodontic treatment, intraradicular post, intracoronal post and dental prostheses treatment, are the parameters used in dental radiographs.¹⁵

Conclusion

Forensic odontology having a great effect or influence in the field of dentistry, which is practiced worldwide. This article aims to enlighten the importance of forensic odontology and its relationship with periodontium. Forensic odontology plays a significant role in identifying the deceased by determining sex and age, using various techniques, including that of the gingiva and periodontium.

Clinical implications

This article gives an overview of structures of periodontium and its application in forensic science which implies maintaining a dental record will further aid in the process of legal issues. A dental record should contain all related information of the patient, his medical history, teeth with restorations, or pathologies, missing teeth, soft tissue changes in gingiva, alveolar bone loss, treatment planned and done and prognosis. Preoperative and postoperative photographs and radiographs all should be maintained. It would not only help in forensic odontology but also in cases of medico legal issues, insurance and consumerism. Computer generated dental records earn more benefit because it can be easily networked and for routine professional consultation forensic in cases.¹⁶

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