INTRODUCTION

Forensic odontology is a specialized field of dentistry which analyses dental evidence in the interest of justice. Dental evidence has been used for the identification of victims and suspects in mass disasters, abuse and crimes [1]. Dental evidence is presented in the following sequence in the court of law i.e., proper handling, thorough examination, evaluation and presentation [1].

A working classification for forensic odontology was formulated based on the relationship of various dental specialties with forensic odontology [2]. A detailed review about the utility of these dental specialties with forensic odontology was ascertained to understand the forensic implications of each individual dental specialty and to do research in the parent dental specialty [3]. The new working classification proposed for forensic odontology based on its relationship with other dental specialties was evaluated in scientometric research [4].

The introduction of universal coding will be of immense help in forensic dental identification. A simplified Indian coding was proposed for forensic dental identification based on the interrelationship of dental specialties with forensic odontology [8]. A simple and cost-effective technique, easily performed in dental clinic practice using discarded Lead foil of the intraoral periapical radiograph as an inclusion agent in the dentures of the individuals for the identification process was proposed recently [9].

Periodontics is a clinical dental speciality dealing with diseases of the periodontium [3]. This speciality is utilized for identification of individuals through morphology and pathology of periodontium and is also utilized for age estimation studies which include periodontosis, root transparency and root length. This paper aims to discuss the periodontics perspective in identification and age estimation in terms of the following aspects.

METHODS

A review of the literature was done using PubMed to evaluate the periodontics perspective in identification and age estimation. The following keywords were searched in PubMed: Identification, gingival morphology and pathology, the contour of the gingiva, gingival recession, gingival enlargement, interproximal craters, the color of the gingiva, plaque and calculus deposits, periodontal ligament morphology and pathology, thickness of periodontal ligament, widening of periodontal ligament, lateral periodontal cysts, periodontal abscess, status of alveolar

ABSTRACT

Forensic odontology is a specialized field of dentistry that analyses dental evidence in the interest of justice. Periodontics is a clinical dental speciality dealing with diseases of the periodontium. This speciality is utilized for identification of individuals through morphology and pathology of periodontium and is also utilized for age estimation studies which include periodontosis, root transparency and root length. This paper aims to discuss the periodontics perspective in identification and age estimation.

KEY WORDS: Forensic sciences, forensic odontology, age estimation, identification, periodontics, perspective, periodontium
bone, height, contour and density of crestal bone, thickness of interradicular bone, pattern of lamina dura, trabecular bone pattern, bone islands, bone loss, periodontal cosmetic surgeries, crown lengthening procedure, root hemisection, regenerative surgery, periodontal microsurgery, age estimation, periodontosis. Root transparency and root length.

**DISCUSSION**

**Identification**

Periodontics is the speciality of dentistry dealing with diseases of the gums and other structures around the teeth [3]. This speciality is utilized for identification of individuals through gingival morphology and pathology, periodontal ligament morphology and pathology, status of alveolar bone and periodontal cosmetic surgeries [Table 1].

**Gingival Morphology and Pathology**

The clinical parameters of the gingiva such as contour, recession, enlargements, interproximal craters, color (inflammatory changes, physiological [racial] or pathological pigmentations), dental plaque and calculus deposits were taken into consideration for establishing identity of the individuals [Table 1].

**The Contour of the Gingiva**

The contour or shape of the gingiva varies considerably among individuals and depends on the shape of the teeth and their alignment in the arch, the location and size of the area of proximal contact and the dimensions of the facial and lingual gingival embrasures [10]. The harmony of gingival contour is jeopardized by improperly constructed dental restorations and prosthetic abutments [11]. The anatomical form, marginal adaptation, marginal discoloration and surface roughness of the dental restorations and prosthetic abutments in relation with the contour of the gingiva should be assessed. Stillman’s cleft (apostrophe shaped indentations extending from the gingival margin apically) and McCall’s festoons (life saver shaped enlargements of marginal gingiva in canine premolar region) associated with occlusal trauma will enhance the identification process [12,13].

**Gingival Recession**

Gingival recession is an undesirable condition presenting as localized and generalized form resulting in root exposure [14]. The etiology of gingival recession was traced to bad oral hygiene practices, high level of dental plaque and calculus and tobacco consumption habit with more cases reported in older population [14]. Gingival recession was reported in young Israeli adults with history of past orthodontic treatment and oral piercing [15]. The presence and extent of gingival recession will increase with age and it is frequently seen on buccal surfaces than on other aspects of the teeth [14]. Gingival recession is also associated with clinical crown length, arch relationship and frenum involvement [16].

**Focal and Diffuse Enlargements of the Gingiva**

Gingival enlargements are quite common and can be classified as focal and diffuse enlargements. The etiology of the gingival enlargement may be inflammatory (abscess), idiopathic (hereditary gingival fibromatosis), drug induced (calcium channel blocker, phenytoin, cyclosporine), granulomatous disease (tuberculosis), neoplasms (leukemia) and any other systemic and local pathology [17-21].

**Interproximal Craters**

Interproximal craters are usually presented in necrotising ulcerative gingivitis with interdental necrosis, punched out ulcerated papillae, gingival bleeding and pain [22]. Similar ulcerative changes of gingiva is also reported in Fanconi’s anaemia and HIV infection [23,24].

**The Color of the Gingiva**

The usual color of the gingiva is coral pink and gingiva will exhibit physiologic pigmentation. The most common site of physiologic pigmentation is the labial part of the gingiva, and the attached gingiva is the most common pigmented anatomical division [25]. The highest rate of gingival pigmentation has been observed at the incisors [26]. The pathologic pigmentations in gingiva may be smoker’s melanosis, melanotic macule, oral melanocanthoma, pigmentation by foreign bodies or induced by drugs, Peutz–Jeghers syndrome, Addison’s disease and oral melanoma [27].

**Plaque and Calculus Deposits**

The oral hygienes status can be assessed by recording plaque and calculus deposits and there is a definite correlation between bad oral hygiene status with higher plaque and calculus deposits [28]. Plaque and calculus deposits will be higher in certain pathologic conditions [29,30].

**Periodontal Ligament Morphology and Pathology**

The clinical parameters of the periodontal ligament such as thickness of periodontal ligament, widening of periodontal ligament and pathologies of the periodontal ligament such as lateral periodontal cysts and periodontal abscess were taken into consideration for establishing identity of the individuals [Table 1].

**Thickness of Periodontal Ligament**

The thickness of the periodontal ligament will be directly related to age and mesioocclusal drifting of teeth [31]. A more recent study on rats about the importance of periodontal ligament thickness, it was interfered that periodontal ligament thickness is directly proportional to root dimensions [32].

**Widening of Periodontal Ligament**

The widening of the periodontal ligament space is seen related to
bisphosphonate-associated osteonecrosis of the jaws, progressive systemic sclerosis and primary hyperparathyroidism [33-35].

Lateral Periodontal Cysts and Periodontal Abscess

The lateral periodontal cyst is a rare developmental odontogenic cyst seen in mandibular premolar region of adults [36]. Lateral periodontal cysts are non-keratinized cysts located adjacent or lateral to the root of a vital tooth [37]. Periodontal abscess is localized, purulent infection within the tissues adjacent to the periodontal pocket that may lead to the destruction of periodontal ligament and alveolar bone [38]. More recently, an unusual case of recurrent periodontal abscess in a 31-year-old male electrician due to his habit of using his teeth as a tool for stripping electrical wires was reported [39].

Status of Alveolar Bone

The clinical parameters of the alveolar bone such as height, contour and density of crestal bone, thickness of interradicular bone, pattern of lamina dura, bone loss (horizontal or vertical), trabecular bone pattern and bone islands were taken into consideration for establishing identity of the individuals [Table 1].

Height, Contour and Density of Crestal Bone

Bone mineral density is an important risk indicator for periodontitis in postmenopausal women [40]. Tobacco consumption induces alveolar crest height loss independently of mandibular bone mass and bone density [41]. Osteoporosis or low systemic bone mineral density is considered as a risk factor for periodontal disease progression [42].

Table 1: Interrelationship of periodontics with forensic odontology

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<tr>
<th>Identification</th>
<th>Gingival morphology and pathology:</th>
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<td></td>
<td>a. Contour, recession, focal/diffuse enlargements, interproximal craters</td>
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<td>b. Colour-inflammatory changes, physiological (racial) or pathological pigmentation</td>
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<td>c. Plaque and calculus deposits</td>
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<td>Periodontal ligament morphology and pathology:</td>
<td>a. Thickness</td>
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<td>b. Widening</td>
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<td>c. Lateral periodontal cysts and periodontal abscess</td>
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<td>a. Height, contour, density of crestal bone</td>
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<td>b. Thickness of interradicular bone</td>
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<td>c. Pattern of lamina dura</td>
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<td>d. Bone loss (horizontal/vertical)</td>
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<td>e. Trabecular bone pattern and bone islands</td>
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<td>Periodontal cosmetic surgeries:</td>
<td>a. Crown lengthening procedure</td>
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<td></td>
<td>b. Root hemisection along with regenerative surgery</td>
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<td>c. Periodontal microsurgery</td>
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Age estimation

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Periodontosis (gum recession)

Root transparency and root length

Thickness of Interradicular Bone

The buccal interradicular cortical bone thickness between canine and first premolar or between first premolar and second premolar is the greatest and between central incisor and lateral incisor is the least and buccal and palatal interradicular cortical bone thickness and alveolar process width will tend to increase from crest to base of alveolar process [43].

Pattern of Lamina Dura, Trabecular Bone Pattern and Bone Islands

Partial or complete loss of lamina dura, delicate or absent trabecular patterns, and an overall granular or chalky white appearance associated with an increase in radiographic density are seen in patients with renal osteodystrophy [44]. Trabecular pattern can be assessed in mandible using periapical and panoramic radiographs [45,46].

Bone Loss (Horizontal or Vertical)

Horizontal alveolar bone loss is seen more often than the vertical bone defects in periodontal patients [47].

Periodontal Cosmetic Surgeries

The periodontal cosmetic surgeries such as crown lengthening procedure, root hemisection along with regenerative surgery and periodontal microsurgery were taken into consideration for establishing identity of the individuals [Table 1].

Crown Lengthening Procedure

Open-flap and minimally-invasive flapless esthetic crown lengthening procedures are usually recommended for the treatment of excessive gingival display [48]. The effect of esthetic crown lengthening procedures play a major role in the perception of whether a person is attractive and whether or not they are perceived as friendly, trustworthy, intelligent, and self-confident [49].

Root Hemisection along with Regenerative Surgery

Hemisection is a viable method of preserving periodontally or endodontically compromised teeth or roots (mainly mandibular first molars) [50]. Among regenerative surgical procedures in periodontics, guided tissue regeneration is still the favourable technique with significant clinical and histologic documentation of periodontal regeneration [51].

Periodontal Microsurgery

Periodontal microsurgery is now grouped under minimally invasive periodontal therapy that preserves dentition and supporting structures and allows less extensive manipulation of surrounding tissues than conventional procedures and accomplishing the same treatment results [52].
Age Estimation

One of the interesting applications of forensic odontology is age estimation by means of teeth [53]. Periodontics is also utilized for age estimation studies which include periodontosis (gum recession), root transparency and root length [Table 1] [2].

Periodontosis

Periodontosis is one of the six dental changes that is used along with attrition, secondary dentin deposition, root translucency, cementum apposition and root resorption to estimate age by Gustafson’s method [1].

Root Transparency and Root Length

The dental features such as root translucency and root length can be used along with the extent of periodontosis to estimate age in adults [54]. Lamendin *et al.* developed a general technique to estimate age of adults at death using two dental features (periodontosis and translucency of the tooth root) and Prince and Ubelaker modified this method, creating a formula for each sex and for different ancestries and obtained more precise age estimations [55].

CONCLUSION

To conclude, this article hopes to sensitize all dental fraternities and periodontics specialists around the globe to know the interrelationship of periodontics with forensic odontology.

REFERENCES

Shamim: Periodontics perspective in identification and age


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