Repair of Experimental Plaque-Induced Periodontal Disease in Dogs

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Summary:

Forty mongrel dogs were used in this study for induction of periodontal disease by placing subgingival silk ligatures affecting maxillary and mandibular premolar teeth during a 12-month period. Experimental premolar teeth received monthly clinical, radiographic, and histometric/pathologic assessments. The results demonstrated significant increases in scores and values of periodontal disease parameters associated with variable degrees of alveolar bone loss. The experimental maxillary premolar teeth exhibited more severe and rapid rates of periodontal disease compared with mandibular premolar teeth. Histometric analysis showed significant reduction in free and attached gingiva of the experimental teeth. Histopathological examination of buccolingual sections from experimental premolar teeth showed the presence of rete pegs within the sulcular epithelium with acanthosis and erosive changes, widening of the periodontal ligament, and alveolar bone resorption. Various methods for periodontal repair were studied in 194 experimental premolar teeth exhibiting different degrees of periodontal disease. The treatment plan comprised non-surgical (teeth scaling, root planing, and oral hygiene) and surgical methods (closed gingival curettage, modified Widman flap, and reconstructive surgery using autogenous bone marrow graft and canine amniotic membrane). The initial non-surgical treatment resulted in a periodontal recovery rate of 37.6 % and was found effective for treatment of early periodontal disease based on resolution of gingivitis and reduction of periodontal probing depths. Surgical treatment by closed gingival curettage to eliminate the diseased pocket lining resulted in a recovery rate of 48.8 % and proved effective in substantially reducing deep periodontal pockets. Open root planing following flap elevation resulted in a recovery rate of 85.4 % and was effective for deep and refractory periodontal pockets. Autogenous bone graft implantation combined with canine amniotic membrane as a biodegradable membrane was used in 18 premolar teeth and failed to improve advanced furcation defects in most teeth. ***J Vet Dent 24 (3); 152 - 165, 2007***

Introduction

Periodontal disease is a common small animal disease. However, the urgency of appropriate dental care is often not emphasized by pet owners and practitioners. The seriousness of this problem is attributed to its insidious nature since the destructive nature of periodontal disease is often difficult to determine based on oral examination.[1-3]

Dental plaque is the adherent bacterial mass attached to tooth surfaces and is considered a key factor in the pathogenesis of periodontal disease.[4-6] Periodontal disease is characterized by an inflammatory process involving the supporting structures of the tooth including gingiva, cementum, periodontal ligament, and alveolar bone.[7,8] The bacteria of dental plaque are capable of initiating the mechanisms of destruction of periodontal tissues.[9,10]

The inflammation of tissues surrounding the teeth is progressive from gingivitis to periodontitis, and ultimately tooth loss.[11] Pathologic changes associated with gingivitis including edema, odor, hemorrhage, and exudates are reversible. Periodontitis is irreversible leading to periodontal pocket formation, bone destruction, and eventual tooth loss.[2,12,13]

The essential goals of periodontal therapy are to remove the supra- and subgingival plaque, decrease the depth of periodontal pockets, and to improve the probing attachment level in order to attenuate the progression of periodontal disease. Conventional therapy routinely involves a pre-surgical phase that utilizes teeth scaling and root planing combined with oral hygiene and chemotherapeutics.[14-19] Recommended surgical periodontal procedures include gingivectomy, flap procedures, and regenerative periodontal surgery.[20-25]

The aims of the present study were to experimentally induce and evaluate periodontal disease with gradations of severity using a ligature-induced model; and, to evaluate non-surgical and surgical methods for treatment of different stages of experimentally induced periodontal disease in dogs.

Materials and Methods

Experimental Model

Forty adult mongrel dogs (male and female, approximately 2-years-old, and weighing an average weight = 25 kg) were used in this study. The dogs were brought to optimal periodontal health over a 1-month preparatory period prior to the initiation of the experiment. Experimental periodontal disease was induced by placing silk ligatures below the gingival margin of the right mandibular second (406), third (407), and fourth (408) premolar teeth and maxillary first (105), second (106), and third (107) premolar teeth.[26] The contralateral teeth served as controls. The dogs were fed a soft diet for 12-months. The experimental and control teeth were subjected to clinical, radiographic, and histometric assessments for periodontal disease monthly during the study period. Clinical parameters included plaque, gingivitis, tooth mobility, furcation involvement, periodontal pocket depth, gingival recession, and attachment level.[27-31] Dental radiographs were taken monthly using an angled wooden stand for securing the animal's head and standardizing angulation of the x-ray beam to minimize variation based on positioning (Fig.1). Radiographic assessment was recorded by scoring the extent of discontinuity of the lamina dura, rounding of the alveolar bone crest, alveolar bone loss,