

ANIMAL MODEL
OF
HUMAN DISEASE

Periodontitis

**Animal Model: Periodontitis
in the Rice Rat
(*Oryzomys palustris*)**

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Biologic Features

The rice rat, or swamp rice rat, *Oryzomys palustris*, is a native American species found wild in the southern United States and in Central and South America. Superficially the rice rat resembles the Norway rat but is much smaller. At maturity the adult male rat weighs 70–80 g. Female rats are consistently smaller and lighter in weight. The rice rat shows a particular susceptibility to destructive periodontal disease, the disease being noted as early as 16 days of age.¹

Comparisons With Human Disease

As in the human form of periodontal disease, the first pathologic change observed in the rice rat is marginal gingivitis. This symptom appears first about the mandibular first molar teeth. (Comparatively, the mandibular arch is more severely involved than the maxillary.) Interproximal areas are soon affected, the gingival tissues losing their normal color and contour. Edema, pocket formation, accumulation of debris, and ulceration occur

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within 90–100 days. Beneath the gingiva, alveolar bone resorption takes place; and as a result the teeth drift apart and are eventually exfoliated.

Heavy plaque accumulates on the tooth surfaces of the rice rat, comparatively more plaque occurring on mandibular than on maxillary teeth. Calculus is not a prominent feature in rice rats up to 120 days of age. Root-surface caries is a frequent occurrence in older animals.

In the rice rat the incidence of disease has been shown to be dependent in large part upon dietary factors.¹⁻³ A soft, fine-particle diet with a high carbohydrate content appears to be essential for the initiation of the disease in young animals.¹⁻³ Replacement of the carbohydrate component with fat or protein has resulted in major reductions in the disease.^{4,5} Also, in the rice rat, periodontal disease has been shown to be coprophagously transmissible.⁶ Unsuccessful attempts have been made to identify the bacterial components responsible.⁷⁻¹¹

Histologically, the appearance of the early lesion is that of an acute inflammatory response. Polymorphonuclear leucocytes appear beneath



Figure 1A—Lingual aspect of the right half of the mandible from an animal on a regular pelleted laboratory diet for 10 months. **B**—Lingual aspect of the left half of the mandible from a 110-day-old rice rat on a soft high carbohydrate diet for 89 days. The exposed root surfaces mark the extent of alveolar bone loss. ($\times 15$)

the junctional and crevicular epithelium and penetrate through the junctional epithelium and into the gingival sulcus. As the lesion progresses, "activated" macrophages appear subjacent to the affected epithelium. The connective tissues are destroyed, and the epithelial attachment migrates apically along the root surface, deepening the pocket. The advanced lesion presents as a destruction of the alveolar bone with fibrosis and granulation of the gingival connective tissues and periodontal ligament space.

Applicability of the Model

Under controlled conditions the rice rat displays a high degree of susceptibility to destructive periodontal disease. Unlike the human disease, which takes years to develop, in the rice rat the disease progresses to a chronic destructive lesion within a reasonably brief time span (Figure 1). The degree of soft-tissue involvement and hard-tissue destruction are measurable by relatively simple methods. The resulting data can be statistically treated to evaluate the effects of dietary, chemotherapeutic, or other influences upon the progression of the disease in experimental and control groups of animals.

Location of Colonies of Rice Rats

Colonies of rice rats are maintained at 1) the Naval Dental Research Institute, Great Lakes, Illinois, 2) Ohio State University College of Dentistry, Columbus, Ohio, 3) the University of Utah (Department of Anatomy), Salt Lake City, Utah, and 4) Harvard Medical School (Department of Anatomy), Boston, Massachusetts.

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