CASE REPORT

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Nutrient Canals of the Alveolar Process as an Anatomic Feature for Dental Identifications

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ABSTRACT: Nutrient canals are anatomic structures of the alveolar bone through which neurovascular elements transit to supply teeth and supporting structures. A dental identification using a nutrient canal of the mandibular alveolar process as the most compelling anatomic feature for antemortem-postmortem radiographic comparison is described. Nutrient canals as a potential marker for clinical disease is also discussed.

KEYWORDS: forensic science, forensic odontology, alveolar process/radiography, mandible/radiography, hypertension/complications

Nutrient canals are tube-like conduits seen in the alveolar bone that contain neurovascular elements that supply teeth and supporting structures. These anatomical structures are frequently seen as fine linear, curvilinear, or circular radiolucencies situated within the interproximal alveolar bone or inferior to root apices. Nutrient canals are found throughout the maxillary and mandibular alveolar processes. Radiographically, they are typically found in the area of the mandibular incisors where the alveolar bone is thin and the canals are not readily obscured by trabeculation and overlapping anatomical structures as occurs in more posterior areas of the jaws (1–3).

Forensic odontological support was requested in determining the identity of a set of human remains in an advanced state of decomposition. The decedent was believed to be an 86-year-old gentleman who had wandered away from a long term care facility two weeks prior. The medical history of the missing person was significant for dementia, a recent cardiovascular accident, and long standing hypertension. While the dosage and exact duration of use was not made available, medications included amlodipine for control of hypertension. Available antemortem dental records consisted of a single, four year old, periapical radiograph of Tooth 22 that was taken prior to its extraction for nonrestorable caries (Fig. 1). Review of the antemortem radiograph showed a peculiar fork-shaped nutrient canal in the edentulous alveolar ridge distal to Tooth 22. In addition to an osteopenic defect distal to Tooth 23, postmortem radiographic examination showed a fork-shaped nutrient canal in the edentulous alveolar ridge distal to the anatomic location of antemortem missing Tooth 22 (Fig. 2). A positive identification was provided based on the morphology of the nutrient canal seen in both antemortem and postmortem radiographs. Additionally, the osteopenic defect seen in the postmortem radiograph that roughly corresponded to the anatomic location and root shape of Tooth 22, seen on the antemortem radiograph that was extracted four years earlier, provided supporting evidence for the identification.

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Discussion

It has long been recognized in forensic dentistry that variation exists in the radiographic appearance of identical anatomic structures. Pulp chamber morphology, crown and root morphology, enamel thickness, and bone trabeculation are but a few structures that have been used in antemortem-postmortem radiographic comparisons in instances where minimal antemortem records are available, restorative treatment is lacking, or only partial remains are recovered (3–5). The use of nutrient canals in dental identification is, however, seldom found in the literature.

Nutrient canals are true canals containing neurovascular and connective tissue components having a length varying from 2.0 mm to 10.0 mm and a width from 0.5 mm to greater than 2.0 mm (6). Reports of the observable frequency of nutrient canals on routine radiographic survey have varied from 5 to 54% of the general population (7,8). Several independent investigators have noted an association in the frequency and number of radiographically observable nutrient canals with increasing age (3,7,8,10). Bilge et al. (8), in a review of 1040 patients, found that nutrient canals were found with increased frequency in people over 35 years of age. The incidence of nutrient canals on radiographic survey are reportedly more common in Blacks than Whites (3,7). No statistically significant variation in sex predeliction for radiographically observable nutrient canals have been observed (8,9).

Kishi et al. (10) reported the incidence and number of nutrient canals increased as the radiographic evidence of bone resorption became more severe in patients with periodontal disease, with the highest incidence found in edentulous patients. Lovett (11), in a study of 444 edentulous patients found radiographically demonstrable nutrient canals in all three sextants of both the maxilla and mandible in 100% of patients studied. This has important implications in the dental identification process as nutrient canals may provide the only landmarks for antemortem-postmortem radiographic comparison in many edentulous cases.

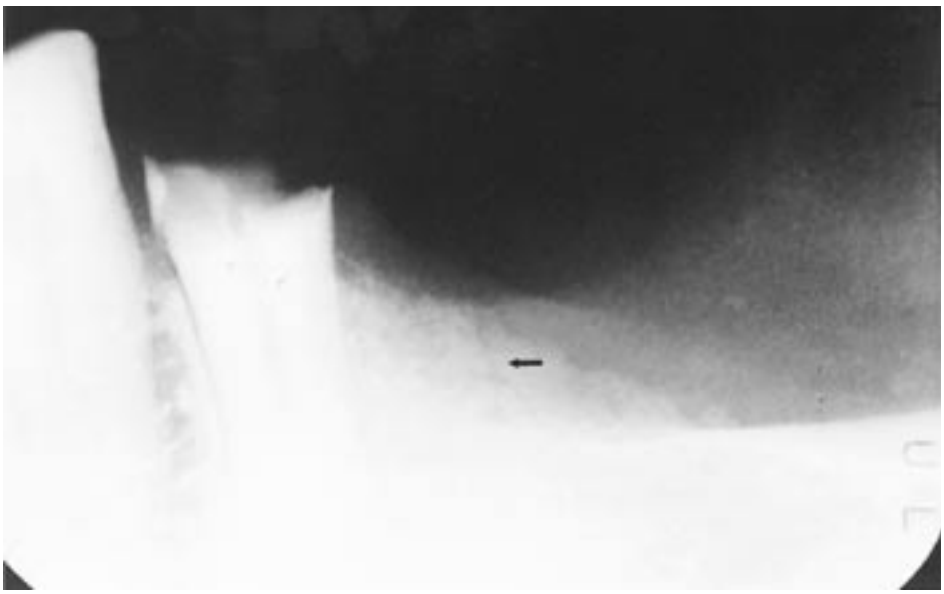

FIG. 1—*Antemortem periapical dental radiograph showing carious Tooth 22 and a nutrient canal (arrow).*

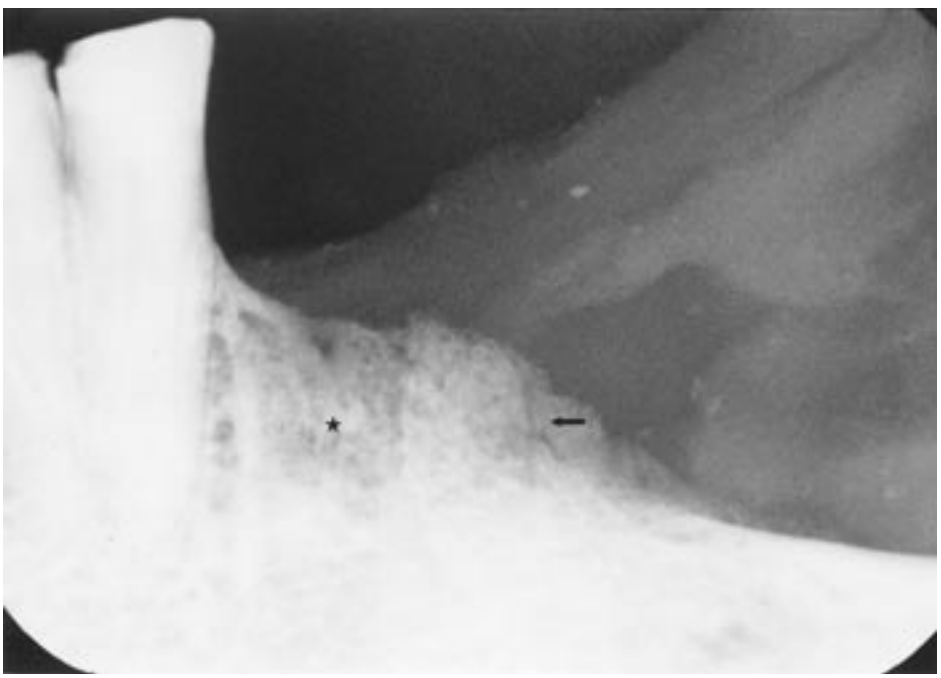

FIG. 2—*Postmortem periapical dental radiograph showing a nutrient canal (arrow) and an osteopenic defect from an incompletely healed extraction of Tooth 22 (star).*

A possible correlation between the radiographic appearance of nutrient canals and systemic disease has been identified. Several investigators have reported an increased incidence of radiographically observable nutrient canals in hypertensive patients versus nonhypertensive patients (3,8,9). Patni et al. (9) found no correlation between the incidence of nutrient canals and the severity of hypertension, however, the incidence of nutrient canals increased progressively with the duration of the disease. It has been postulated that the formation of collateral circulation in response to arteriolosclerotic induced peripheral ischemia and or the hyperplasia and hypertrophy of the vessel walls occurring in hypertensive disease may account for the increased frequency of radiographically observable nutrient canals in these patients (9,12). Vasodilatation, the result of many anti-hypertensive medications, may also play a role in this phenomena. Pierrakou et al. (13) reported an increased incidence of radiographically detectable nutrient canals of the anterior mandible in association with diabetes mellitus that also correlated with the duration of the disease.

The osteopenic defect associated with an incompletely healed extraction site from the extraction of Tooth 22 four years earlier and seen on the postmortem radiograph (Fig. 2), while unassociated with the nutrient canal, was potentially noteworthy. Models

have shown a decrease in bone volume of the alveolus in extraction healing in amlodipine-treated animals (14). The decedent was known to have been treated for hypertension with amlodipine, a second generation calcium channel blocker, for several years.

An increased frequency of radiographically detectable nutrient canals has been reported in association with increasing age, race, edentulism, and systemic disease. In addition to being a useful anatomic feature for radiographic comparison in dental identifications, nutrient canals can provide insight in determining the biologic profile of unknown remains and can act as an important clinical sign alerting the clinician to potential disease in their patients.

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