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Study of amalgam-like particles by polarized light microscopy



KEYWORDS

Amalgam particle;
Polarized light
microscopy;
Energy dispersive X-ray
analysis

Amalgam-like particles are sometimes found in the periapical lesions.¹ In this study, we used polarized light microscopy to study the amalgam-like particles in a periapical scar and two periapical granulomas.

The periapical scar was located at the periapical area of tooth 12 of a 56-year-old female patient. Periapical radiography showed a radiolucent lesion of 5×5 mm with radiopaque materials in the periapical lesion. The patient had a previous periapical surgery with retrograde amalgam filling. In addition, the periapical radiograph showed radiopaque particles in the periapical radiolucent lesion. Thus, the past dental history plus histologic and radiographic findings confirmed that the foreign body materials in the periapical scar were amalgam particles. The detailed histological findings of this periapical scar have been presented in our previous study.¹ Both large and small amalgam particles are discovered in the dense fibrous connective tissue (Fig. 1A). By polarized light microscopy, only few small areas of large black amalgam particles showed birefringence (empty black-boarded arrow, Fig. 1B), but diffuse small birefringent dots were discovered in aggregates of small amalgam particles (solid black arrows, Fig. 1B). In addition, the collagen bundles also exhibited thin band or fiber-like birefringence with marked cross striations (Fig. 1B). Regarding the two periapical granulomas: one was found at the periapical area of tooth 22 of a 52-year-old male patient, and the other was discovered at the periapical area of tooth 12 of a 30-year-old female patient. In hematoxylin and eosin-stained histological sections, both periapical

granulomas showed a well-vascularized fibrous connective tissue with a severe lymphoplasmal cell infiltrate and foci of hemorrhage (Fig. 1C,D). Moreover, a few small and medium-sized amalgam-like particles were noted in the cytoplasm of multinuclear giant cells or free in the fibrous connective tissue stroma (Fig. 1C,D). By polarized light microscopy, the amalgam-like particles were demonstrated as a few small or medium-sized birefringent dots (Fig. 1E,F).

Endogenous hemosiderin particles or cholesterol crystals are not uncommonly found in the periapical lesions.^{2,3} Hemosiderin deposits, usually secondary to chronic bleeding in the periapical lesions, appear as granular golden brown particles in the macrophage cytoplasm.² These hemosiderin particles stain dark blue in the Prussian blue reaction, but they are non-reactive under polarized light.^{4,5} Cholesterol crystals are dissolved during tissue processing and typically appear as small fascicles of empty clefts (so-called cholesterol clefts).² These two endogenous particles or crystals are not difficult to be identified by experienced oral pathologists. Exogenous foreign particles (such as amalgam particles or extruded endodontic filling materials) are less frequently discovered in the periapical lesions. If the clinicians described that retrograde amalgam filling had been performed before or the root canal of the treated tooth was overfilled with extruded filling materials noted on the periapical radiograph, then it might be easier to identify the origin of the exogenous foreign particles in the periapical tissues sent for histopathological examination. The metal particles like amalgam or other metal particles show

<https://doi.org/10.1016/j.jds.2021.06.009>

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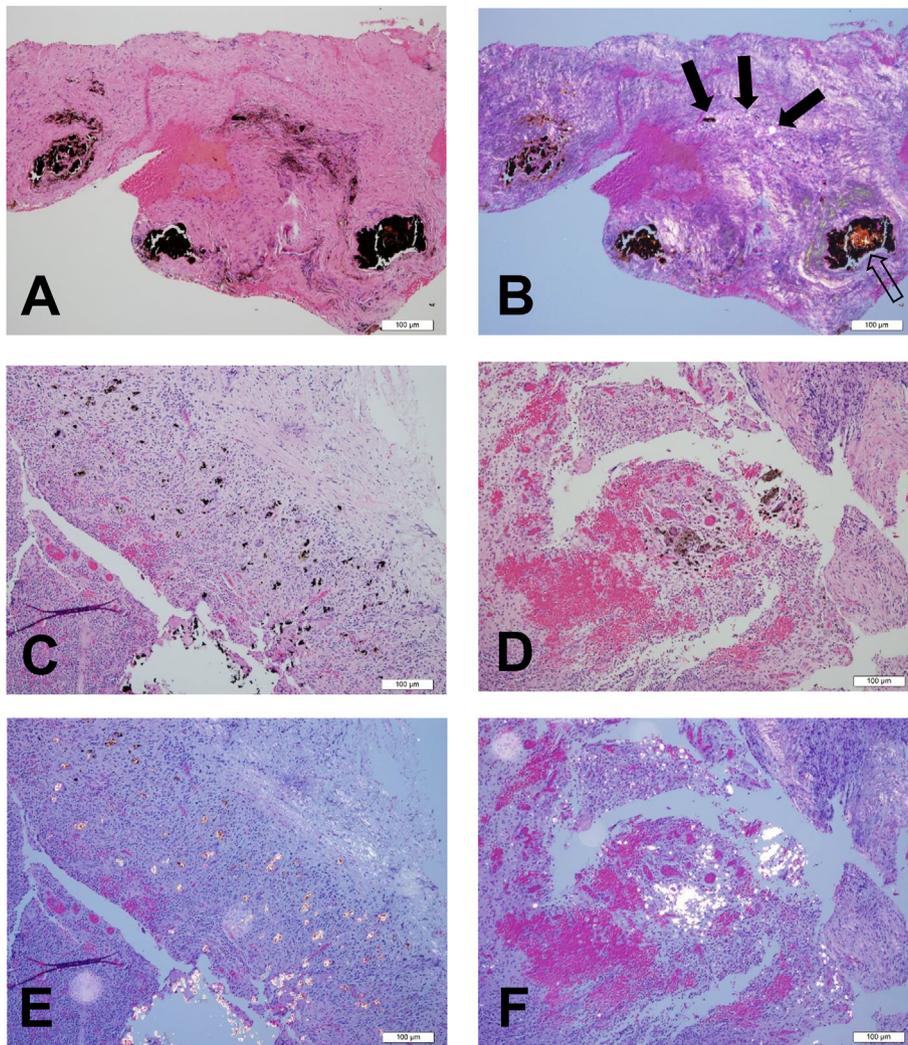


Figure 1 Hematoxylin and eosin-stained histological sections studied by conventional (white light) and polarized light microscopy. (A) Medium-power microphotograph exhibiting a periapical scar composed of dense fibrous connective tissue with depositions of both large and small black amalgam particles. (B) By polarized light microscopy, only few small areas of large black amalgam particles showed birefringence (empty black-boarded arrow), but diffuse small birefringent dots were discovered in aggregates of small amalgam particles (solid black arrows). In addition, the collagen bundles in the periapical scar also exhibited thin band or fiber-like birefringence with marked cross striations. (C and D) Medium-power microphotographs of two periapical granulomas showing that each was composed of a well-vascularized fibrous connective tissue with a severe lymphoplasmacytic cell infiltrate and foci of hemorrhage. Moreover, a few small and medium-sized amalgam particles were noted in the cytoplasm of multinuclear giant cells or free in the fibrous connective tissue stroma. (E and F) By polarized light microscopy, the amalgam-like particles in both periapical granulomas were shown as a few small or medium-sized birefringent dots. (Hematoxylin and eosin stain; original magnification; A, B, C, D, E, and F, 10 ×).

birefringence by polarized light microscopy and this may help the oral pathologists to confirm the origin of the exogenous foreign particles.^{4,5} However, the polarized light microscopy cannot distinguish amalgam particles from other metal particles. In contrast, the energy dispersive X-ray analysis can be used to identify the exact metal elements contained in the foreign particles.^{4,5} By energy dispersive X-ray analysis, the black/brownish fragments and yellow/brown granules containing Au, Ag, Cu, Hg, Sn and Zn are compatible with amalgam and the fine black/brown/yellow granules containing Ag, Ba, Bi, Cu, S, Ti and Zn are compatible with endodontic sealer components.^{4,5}

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this article.

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Received 17 June 2021

Available online 1 July 2021

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