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## Angiogenesis in regenerative dentistry

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Angiogenesis is the formation of new blood vessels from pre-existing capillaries. It is one of the most important concepts discussed in regenerative endodontic procedures. These procedures are divided into two separate categories: (1) the dentin–pulp complex and (2) dental pulp regenerations. In dentin–pulp complex regeneration, the summit goal is to perform an effective pulp capping treatment that can provide a suitable condition for differentiation of dental pulp stem cells to odontoblast-like cells capable of producing the reparatory dentin.<sup>1,2</sup> The role of local angiogenesis in this procedure includes the establishment of an effective blood supply for inflammatory and regenerative phases to provide the nutrition and oxygen required and the recruitment of perivascular dental pulp stem cells to the pulp tissue beneath the injured area.

The other field of regenerative endodontics deals with the revascularization of a vacant dental canal after pulp necrosis.<sup>1</sup> In this procedure, the whole dental canal is irrigated with sodium hypochlorite followed by ethyl-enediaminetetraacetic acid solutions and then disinfected with a triple antibiotic paste, including ciprofloxacin, metronidazole, and minocycline to eliminate microorganisms.<sup>3</sup> Thereafter, the irritation of periapical tissue causes bleeding into the empty canal to bring stem cells of the apical papilla and also to form a matrix for growth and differentiation of these cells to pulp cells.<sup>1</sup> The role of angiogenesis in this procedure is to provide the stem cells of the apical papilla with the necessary elements to begin the dental pulp regeneration process.<sup>4</sup> Also, angiogenesis is a key factor for the survival of the tissue-engineered stem cells, which have been cultured and then transplanted into the vacant dental canal.<sup>5</sup>

These facts clearly indicate that angiogenesis plays a pivotal and fundamental role in regenerative endodontics. The issue that has been less discussed or perhaps neglected is the impact of dental materials, such as pulp capping materials or disinfecting solutions and antibiotic pastes, on angiogenesis events. It will be informative to evaluate the angiogenic properties of dental materials in order to determine which material is proangiogenic and which one has antiangiogenic activity.

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