4.2 Collagen Pharmacology

Collagen Matrix

Type I collagen is the major protein component of bone. [Turek, 1984] Bone collagen differs from most soft tissue Type I collagens, as it is highly insoluble due to the presence of many intra- and inter-molecular crosslinks. The insoluble collagen matrix is osteoconductive, and provides a resorbable scaffold for anchorage-dependent cell proliferation and differentiation. Type I collagen is composed of two identical alpha-1 chains and one alpha-2 chain. Alpha-1 and alpha-2 have similar amino acid compositions, and are each composed of about 1050 amino acid residues. Because of its vital role in maintaining tissue structure and integrity, and its biological and physiochemical properties, collagen has been used extensively in a variety of medical products for a number of clinical applications, including dermatology, orthopedics, and cardiovascular surgery. [Marks, 1999]

The collagen matrix in OP-1® Putty is a highly-purified preparation of bovine bone-derived Type I collagen and supports osteogenic activity in the presence of recombinant human OP-1. The collagen matrix is present as an insoluble powder with a particle size ranging from 75 to 425 µm.

Animal studies using the rat subcutaneous (SC) implant assay have shown that in the absence of OP-1, implanted collagen matrix is resorbed slowly, and no bone formation occurs. [Sampath, 1992] However, in the presence of OP-1, there is a sequential cellular response at the interface of the OP-1 and the collagen matrix that includes fibrin binding, stem cell chemotaxis and proliferation, chondroblasts differentiation, cartilage calcification, vascular invasion, bone formation, remodeling, and bone marrow differentiation. In order for this multistep cascade of bone formation to occur, it appears that the collagen matrix needs to: a) associate with the OP-1, b) provide a substrate for the recruitment and attachment of progenitor cells, and c) accommodate each step of the cellular response during bone formation. In addition, the matrix must be biocompatible and biodegradable; the collagen matrix acts as a temporary scaffold.

References

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