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Growth Factors in CGF

Growth factors are proteins which regulate the complex processes of wound healing. Growth factors play a main role on cell migration, cell proliferation and angiogenesis in the tissue regeneration phase. These growth factors are mainly located in blood plasma and platelets and it for this reason that platelet concentrates have been widely used to accelerate tissue regeneration and repair in both the dental, medical and cosmetic arenas.

Platelets contain a variety of autologous growth factors and substances, including:

- **Platelet-derived growth factors (PDGF) -** recruits neutrophils, macrophages and osteoblasts
- **Epidermal growth factors (EGF)** – stimulates production of keratinocytes
- **Transforming growth factors (TGF-b1, TGF-b2, TGF α)** – stimulates Collagenesis and extracellular matrix production
- **Vascular endothelial growth factors (VEGF)** - stimulates the growth of new blood vessels. It is produced by the peripheral circulatory system cells (macrophages and T cells) but especially by platelets. It is directly involved in the control of the behaviour of the endothelial cells, particularly in their proliferation, migration and specialisation.
- **Fibroblast growth factor (FGF)** - These are a large family of polypeptides (from FGF-1 to FGF-18) and the most important are FGF-a (acid) and FGF-b (base), also called heparin-bound growth factors. They contribute to bone healing after fractures, to the development of the vascular, nervous and skeletal systems and in a variety of normal and neoplastic tissues. They help angiogenesis, chemotaxis and mitogenesis, stimulating the growth of fibroblasts, myoblasts, osteoblasts, endothelial and neuronal cells.
- **Insulin-like growth factors (IGF)** - Insulin-like growth factors are hormone-dependent polypeptides and can be divided in IGF-I and IGF-II. They show a high concentration in periosteum, in the fibrous callus of fractures, in the ectopic bone induced by the demineralised bone matrix. They are produced by the bone cells, but can be incorporated in the calcified matrix and released during re-absorption. They mainly exert their effects on osteoblast precursors, stimulating their differentiation and proliferation, but also on the osteoblasts themselves, which are stimulated to replicate. They also promote the production of type I collagen and bone matrix synthesis, helping to accelerate the healing process.
- **Fibrinogen** - the extensive cross-linking of fibrin a-chains during clot formation strongly enhances mesenchymal cell migration essential for tissue regeneration.
- **Cytokines**
- **Stem Cells in CGF** - the blood contains undifferentiated, primitive, precursor cells that are multipotent, ie. they are capable of differentiating in to any haematopoetic cell or tissue, including those required for regeneration and repair of hard and soft tissues. These stem cells are designated as CD34+ cells by reference to the surface antigen or marker on the cells that is encoded by the CD34 gene.

Injections of CD34+ Stem Cells have been used clinically to treat various diseases including Spinal Cord Injuries, Liver Cirrhosis and Peripheral Vascular disease, in addition to skin rejuvenation therapies.

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