Spinehealth and Disease

The Healing Spine

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Spinal Tissue Remodeling and Repair

Stages of Healing the Spine

The body responds to injury with an inflammatory process that initiates a cascade of tissue repair and remodeling. The healing process has three identifiable stages or phases that occur over the time period of recovery, they are the inflammatory, proliferative, and remodeling stages. Once tissue is injured, the process of healing begins immediately.

Phase 1: The Inflammatory Stage

The inflammatory stage is the first stage towards healing and remodeling of tissue. During this stage cells are mobilized to the rescue. Specialized white blood cells migrate to the area of injury and begin to clean up the debris between the cells and around the blood vessels. This is accompanied by the local release of blood clotting factors that help reduce and eventually halt bleeding from injured small blood vessels (capillaries). During the inflammatory stage of healing, there is increased blood flow and migration of fluid into the injured area. The initial inflammatory response generally lasts approximately 2-4 days after initial injury. The intensity and duration of the inflammatory stage is related to the degree of tissue compromise.

During the course of inflammation, white blood cells and other cells, which perform cleanup activity migrates to the injured region. This portion of the inflammatory reaction helps dispose of injured tissue byproducts that could continue to promote inflammation. The cleanup process helps to set the stage for tissue repair.

The initial phase of healing is characterized by increased blood flow to the area secondary to blood vessel dilation. The dilation of local blood vessels helps deliver the necessary white blood cells and other cellular elements to the region. During this phase of healing, the specialized white blood cells cleanup most of the foreign debris helping set the stage for the next phase of healing, which is the fibroblastic-repair phase.

Phase II: The Proliferative Phase (Fibroblastic Repair Phase)

The proliferative phase of healing begins during the inflammatory phase. This begins by the second to fourth day after tissue compromise. During the proliferative phase, specialized cells migrate to the area of compromise. One of these cells is the fibroblast. Fibroblasts have special properties that allow them to manufacture the building blocks for reparative tissue referred to as collagen. Collagen is lined up and becomes oriented so that it can serve as an effective infrastructure for the reparative process to build upon.

The proliferative stage generally lasts for two to three days up to six to eight weeks after injury. During this stage damaged and compromised tissue is either repaired or replaced. This process results in the formation of scar tissue (fibrosis). The development of too much scar tissue can result in adhesions that restrict joint and soft tissue movement. The repair process during the proliferative stage can be adversely influenced by inappropriate activity, age, underlying medical disorders, malnutrition, poor general health, and re-injury during this stage. The tissues remain weak and are susceptible to be re-injured during this stage.

The period of scar formation is also referred to as fibroplasia. This generally develops within the first few hours after the injury, and it can last for as long as 4-8 weeks. During phase II of the repair process many of the clinical signs and symptoms associated with the acute inflammatory response resolve or diminish.

During the second phase of healing there is growth of endothelial capillary buds or small blood vessels into the wound stimulated by a localized lack of oxygen. With increased delivery of blood flow and oxygen, there is a corresponding increased delivery of nutrients that is essential for tissue repair, regeneration, and remodeling of the injured region.

There is formation of a delicate transient form of connective tissue referred to as granulation tissue occurs paralleling the breakdown of the fibrin clot. Granulation tissue consists of fibroblasts collagen, and capillaries. It helps fill the gaps during the healing process. Specialized cells referred to as fibroblasts begin to accumulate at the wound site, arranging themselves parallel to the capillaries. They begin to synthesize an extracellular matrix or material, which contains protein, fibers of collagen, and blastin. These cells also produce a ground substance in the form of glue, which helps bind the tissue elements together. Approximately 6-7 days after injury, fibroblasts begin laying down collagen fibers. The fibers assume a random fashion forming the initial phase of scar becoming more organization as the injury site continues to heal. As the collagen proliferates the strength of the wound increases.

The presence of persistent or recurrent inflammatory response with continued release of inflammatory chemicals can promote extended scar tissue development of fibroproliferation. Excessive fibrogenesis can lead to irreversible tissue damage. This can result in adhesive changes within the tissue.