

Wound healing

Sanatio per primam intentionem

By this way, sterile wounds, mostly cuts with smooth edges close and heal without a major inflammatory reaction (the edges of the wound are first glued together with fibrin and then a reparative inflammation takes place, creating a fibrous scar).

- The edges of the wound are glued together by **fibrin** from a small blood clot, and a thin protective crust forms on the surface.
- After 2 - 3 hours, a small leukocyte infiltrate and mild hyperemia appears at the edges of the wound as manifestations of the **reparative inflammation**.
- The epithelial cells of the basal layer around the wound increase their mitotic activity and move to the edges of the wound – after 2 - 3 days, the surface of the wound under the coagulum is **re-epithelialized** with a uniform layer of basal cells.
- The subepithelial clot is gradually removed by macrophages and replaced by **granulation tissue** with capillaries, fibroblasts and myofibroblasts.
- After 10 - 14 days, the edges of the wound are connected by newly formed fibrous tissue. There is normal epithelium on the surface, the rest of the coagulum is already degraded. **Remodeling of the fibrous scar** takes place with the formation of staggered collagen fibers which ensures adequate strength of the tissue, this process lasts for several weeks. (However, even after this, the elastic fibers are missing. Complete regeneration with the original strength and elasticity of the fibrous tissue occurs after months to years).



Scar on hand after 13 days

Scar on hand after 18 days

Scar on hand after 22 days

Scar on hand after 48 days

Sanatio per secundam intentionem

This is how infected wounds or wounds with large gaps heal. First necrotic and infectious debris is removed via an acute inflammatory reaction (mainly purulent, with exudation and infiltration). In the second phase, the proliferation of granulation tissue begins with self-healing (the wound heals from the bottom of the granulation tissue and epithelization from the sides).

- The defect is filled with a blood coagulum containing fibrin and an **acute inflammation** develops during which a significant leukocyte infiltration on the border to the undamaged tissue forms.
- After a few days, the superficial blood coagulum and exudate turn into a dry **crust**. Between the crust and the proliferating granulation tissue at the base of the wound, a layer of **epithelium** moves from the surroundings, the edges of the wound contract thanks to the myofibroblasts of the granulation tissue.
- After one week, the surface crust falls off, the wound contraction and **proliferation of the surface epithelium** continues, pink **granulations** formed by capillary loops are macroscopically visible at the base of the wound.
- After about 3 weeks, the surface of the wound is covered with a uniform layer of epithelium, cells and capillaries recede in the newly formed fibrous tissue, bundles of fibrous fibers are arranged parallel to the surface, the defect is not completely filled, the healing wound is slightly sunken, and only after months it is covered with differentiated epithelium, a **massive fibrous scar** remains.

In the case of an imbalance between the formation of granulation tissue and epithelization, a defect may occur after wound healing:

1. **Prevailing epithelization:** an indented wound is formed
2. **Predominating granulation tissue:** it protrudes above the surface like so-called living flesh (caro luxurians), in predisposed individuals a keloid (stiff collagenous tissue, often hyalinized) develops.

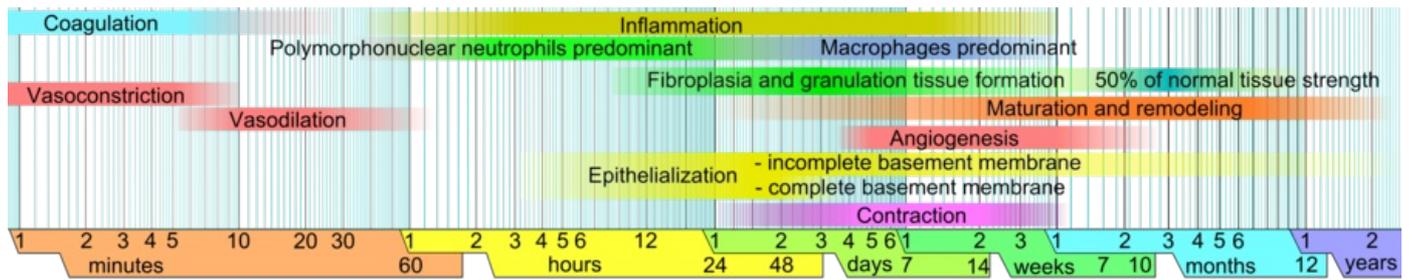
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