

Honey as a tool for tissue engineering

Honey has a long and fascinating history. In fact, since Biblical times and before, honey has been utilized by humankind for its beneficial health effects. The ancient Egyptians, Assyrians, Chinese, Greeks and Romans utilized honey in the treatment of wounds and intestinal disorders. Honey for wound repair was probably its first use for human health. However, the belief that honey is a nutrient, a drug and an ointment has been carried into our days.

Nevertheless, with the antibiotics era, the use of honey has been abandoned. Misuse of antibiotics, the emergence of resistant bacteria, and rising interest in natural remedy provided an exceptional opportunity for honey and other hive products to be re-considered as antibacterial agent, non-toxic to human cells and tissues. Wound healing is of great relevance for regenerative medicine and a particular focus is set on natural compounds. In spite of a wide literature about honey clinical uses, the cellular and molecular mechanisms are still largely obscure.

We have demonstrated that honey is little cytotoxic on skin cells, confirming that honey can be used safely not only for external applications on healthy skin, but also as a dressing on wounds (Ranzato *et al.*, 2012, Ranzato *et al.*, 2013).

We have also demonstrated that honey is able to boost re-epithelization activating epithelial-mesenchymal transition (EMT) (Ranzato *et al.*, 2012). The EMT is a process during which keratinocytes, in the wound edges, lose their epithelial phenotype and transform into actively moving cells. We also observed involvement of H₂O₂, not only as honey antibacterial agents, but also as a main mediator of honey regenerative effects (Martinotti *et al.*, 2019).

The field of tissue engineering aims to regenerate damaged tissues by combining cells with highly porous scaffold biomaterials, to guide the growth of new tissue.

Scaffolds are not simply supports but they interact with the cells to actively facilitate and regulate their activities. Therefore, the scaffold may also be useful as a delivery vehicle or reservoir for exogenous growth-stimulating signals, such as growth factors, to speed up regeneration.

Several authors are proposing to use honey (Martinotti *et al.*, 2018) for scaffolds to support, in association with its antibacterial proprieties, wound repair and tissue regeneration.

The preliminary observations about the scaffolds incorporating honey provide the rational for its use in an increasing number of applications, including tissue repair and regeneration. However, other researches are strongly needed to identify the honey active components and better honeys for tissue engineering.

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Publications

[Honey, Wound Repair and Regenerative Medicine.](#)

Martinotti S, Ranzato E

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[Honey-Mediated Wound Healing: H₂O₂ Entry through AQP3 Determines Extracellular Ca²⁺ Influx.](#)

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