Letters from the Lactide Frontiers 2019

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Polylactic Membranes (PLMs) based on Polymers from mixtures of lactic acids have been used in burns treatments for nearly twenty years. They are established as a well-recognized treatment method that allows for short healing time, low complications, excellent cosmetic results in superficial, deep partial thickness and even small full thickness burns [1-9] under reduced pain. This poster will try to explain the basic and the “Lactate Effect” in burns treatment and correlate this with implications for the clinical use.

We know that polylactides degenerate to chemical fragments releasing lactate and lactic acid [10]. Lactate and lactic acid serve as an energy source for the cells [10,11]. Both substances can permeate the cell membranes either due to their molecule size or to active transport by the monocarboxylyl transporter (MCT) protein shuttle system. Inside of the cell, lactate can serve as an energy source via the Cori cycle or lactate can oxidize to pyruvate (via lactate dehydrogenase), which can then oxidize to acetyl-CoA and fuels the TCA cycle in mitochondria producing the metabolic products carbon dioxide, water, and NADH which provides the energy-rich NAD.

Lactate and pyruvate act as potent antioxidants [10,12–14] within the cells. Medical literature describes the role of oxidative stress in an increasing manner.

Lactate acts on cytokines and increases TGF-β activation, Hypoxia Inducible Factor, VEGF, and others as many studies showed [15–18].

Polylactic membranes act as activators in wound healing and support curing by supplementation of energy. Telomeres conservation will contribute to a reduction of cell-aging and eternization, maintaining the rate of duplications and the quality of the skin. TGF-β affects keratinocytes, completing the activation status for healing. In dermal tissue, it increases fibroblast growth, collagen, and extracellular matrix synthesis as well as neovascularization. It acts as a radical scavenger as well. Clinical findings bolster these laboratory results. Using these effects enables you to use polylactides as a toolbox for a broad range of indications.

Surface and structure effects

| Membranes reduce fluid and energy loss |
| Membranes protect against Superinfection |

**Membranes protect against Infection even in DPT burns with non-wound associated infections- No difference in healing time**

<table>
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Hartmann, Sanders, Haller ABA 2019

**Barrier effects**

**Chemical effects**

**Metabolic effects**

Wound healing effects

“Externally applied lactate simulates hypoxic conditions under normal oxygen pressure”


Lactate acts as a signal molecule promoting wound healing

Lactate activates
- TGF-β and VEGF even without the HIF pathway.
An addition of extracellular lactate leads to
- significant short-term elevation of interleukin-1β, a long-term elevation of VEGF and transforming growth factor-β1, and a 50% elevation in collagen deposition

Fibroblast proliferation (Penn 2012)
ECM formation like hyaluronan (Stern 2002)
Collagen synthesis and deposition (Penn 2012)
Angiogenesis (Ring 2011, Porporato 2012)

Lactate acts on dermal tissue

Lactate acts on epidermal tissue via TGF

IL-1
TNF – activation state
DEDifferentiation
ECM creation
Cell motion, forming of filopodia
Proliferation
Redifferentiation
reverting keratinocytes to basal phenotype

Roussel et al, 2018

Systemic effects

**Acts as Free Radical Scavenger**

Use in moist Desquamation due to Radiation: Rothenberger 2016

**Reduces oxidative stress**

**Reduces systemic inflammatory response**

Fluid creep
Stabilization of glycosylax
Scar development

Gürünülüoğlu K1, Demircan M1, Taşçı A1, et al 2019

**Membranes reduce fluid and energy loss**

**Membranes protect against Superinfection**

PLM protects against Infection even in DPT burns with non-wound associated infections—No difference in healing time

Adapted from “Lactate—a signal coordinating cell and systemic function, Wound Healing: 1st Edition.”