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Management of Burn Wound and Burn Scar Using CEH (Cultured Epidermal Homograft)

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Advances in the critical care, resuscitation, ventilation, and nutritional management have improved survival after severe burn, however, the extensive damage caused by burns still constitute a major surgical challenge for wound cover and healing. Methods for handling burn wounds have changed in recent decades and increasingly new dressing materials are being applied. Immediately after burn injury, several events occur to initiate repair to the damaged tissue. A wound is defined as a break in the epithelial integrity of the skin. However, the disruption could be deeper, extending to the dermis, subcutaneous fat, fascia, muscle or even the bone. Normal wound healing involves a complex and dynamic process involving soluble mediators, blood cells, extracellular matrix components, and resident cells that eventually result in the restoration of tissue integrity, but superbly orchestrated series of overlapping processes resulting in a varying degree of functional and structural restoration. When successful, wound healing restores normal function with a well-organized minimal scar. But when the control mechanisms are abnormal, chronic wound or hypertrophic scar formation can occur. Wound healing occurs in interrelated and interdependent phases: inflammation, cell proliferation, and remodeling.

Over the past 20 years, extensive cellular and molecular details have been elucidated regarding the regulation of cutaneous wound healing. Despite this knowledge, modulation of the intracellular and cell-to-cell communication systems that control wound healing and lead to effective repair has not been established. In the mean time, various wound healing promoting agents based on previous scientific information, including synthetic materials, biologic materials, bioactive molecules, and so on, were introduced. However, through many studies, it is certain that wound dressing materials are often limited to wound maintenance than complete healed wound production, and that no single exogenous agent can effectively mediate all aspects of a wound-healing response. Thus, successful cutaneous wound healing necessitates combination of many wound healing related agents and moreover, cell providing therapy. In order to get wound healing of good quality, this concept is essential, especially in wound remodeling phase as well.

The possibility to rapidly multiply a large number of keratinocyte under culture conditions with intervals of cell-multiplication of less than 24h based on the breakthrough technique by Rheinwald and Green in 1975 that allowed keratinocytes to be successfully cultured and subcultured in clonal cell densities on a "feeder-layer" of lethally irradiated mouse fibroblasts renders the chance to grow epidermis in the quantity of the complete body´s surface within three to four weeks out of a single small skin biopsy. The role of epidermal keratinocytes in the early phases of normal unimpaired wound healing has been studied extensively. Activated keratinocytes are a source of specific pro-inflammatory cytokines and fibrogenic and growth factors, and as such have importance in inflam-

mation and wound healing. However, little is known about the cell biological processes during the later phases of dermal matrix formation and remodeling of the scar tissue. It is hypothesized that hypertrophic or other kinds of scarring results from abnormalities in the epidermal-dermal crosstalk rather than from isolated defects in the dermis. In addition, Keratinocytes can regulate the collagen synthesis of dermal fibroblasts, and conversely keratinocyte growth is supported by growth factors produced by fibroblasts.

Cultured human epidermal keratinocytes grafts as a source of epidermis offer an ″off the shelf″ treatment for acute and chronic wounds. It is reported that cultured sheets of allogeneic human keratinocytes promote faster reepithelialization of partial thickness wounds and donor sites, more normal pigmentation, and lower frequency of erythema in the newly formed epidermis, and that cultured human epidermal keratinocytes autografts provide neo-epidermis and achieve a permanent wound closure. In addition to, these grafts are already used in worldwide clinical field.

The author tried them to apply in burn wound and scar management in terms of good qualitative wound healing related to epidermal-dermal interaction in wound remodeling. The several research works and clinical trials of the author for this concept will be provided.