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Editorial

Stem cells for skin rejuvenation

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Stem cells are self-renewing cells that can differentiate into specialized cell types. Pluripotent stem cells, i.e. embryonic stem cells (ESC) or induced pluripotent stem cells (iPSC) differentiate into cells of all three embryonic lineages. Multipotent stem cells, like hematopoietic stem cells (HSC), adipose derived mesenchymal stem cells (ADMSCs) can develop into multiple specialized cells in a specific tissue. Unipotent cells differentiate only into one cell type.

The next big breakthrough in the ongoing search for younger looking skin would be stem cells. Stem cell based therapies have been used in the field of cosmetic and plastic surgeries due to their abilities to repair and rejuvenate different types of tissues. There are two types of cumulative aging, intrinsic aging which is a programmed aging and extrinsic aging because of different physiological and environmental reasons.[1] Skin integrity is gradually lost with aging. Intrinsic aging results in obvious wrinkling appearance of the skin whereas, wrinkles, loss of elasticity, dyspigmentation, hyperkeratosis, discoloration and even appearance of neoplasms occur as a result of photoaging.[1-3]

The structural and functional role of extracellular matrix (ECM) of skin containing glycosaminoglycan, collagen and elastin is crucial for maintaining the appearance and elasticity of skin.[4] Collagen accounts for 70% of the weight of the dermis mainly type I & III and largely responsible for strength of dermis and reduction of wrinkles. Elastin helps to keep resilience and repair of skin.[4] Both components of the skin should have a proper organization in order to keep the strength and elasticity of skin.[5] Increased activity of collagenase, elastase and hyaluronidase with aging results in degradation of ECM. Ultraviolet rays increases production of collagenase by human dermal fibroblasts resulting in appearance of wrinkles.[6]

Mesenchymal stem cells (MSCs) exert proliferation effect on human dermal fibroblasts (HDF) through cell to cell interaction and paracrine activity. This results in upregulation of collagen type I, III, fibronectin and downergulation of matrix metalloproteinase - 1(MMP-I).[7]

They can differentiate into multiple skin cell types including keratinocytes, endothelial cells and pericytes and have potential role in skin repair and regeneration.[8] There is still lack in understanding of physiological behavior and mechanisms of differentiation in order to make them more effective clinically.[9]

Adipose derived MSCs, showed antiwrinkle effect induced by UVB irradiation. This effect was mainly due to increase in collagen type I that resulted in increased collagen content in the dermis and also due to decrease in the UVB-induced apoptotic cell deaths.[10]

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MSCs secrete many growth factors and cytokines such as epidermal growth factors (EGF), basic fibroblast growth factor (bFGF), Transforming growth factor (TGF-b) and growth differentiation factor-11 (GDF-11),[11,12] that is considered as an essential factor for rejuvenation because it stimulates growth and differentiation of ECM proteins including collagen I & III, elastin and fibronectin in HDF.[13]

Oxidative stress is another important factor attributing to aging. With aging antioxidative defense mechanisms decrease and reactive oxygen species production (ROS) increase.[14]

MSCs exhibit antioxidative activity under various conditions, by increasing the level of glutathione and superoxide dismutase and modulating the activation of antioxidant associated proteins. This potent antioxidant effect provide protection for dermal fibroblasts and keratinocytes against oxidative stress, and consequently accelerate skin wound healing.[15]

There is an intricate relationship between stem cells and various cellular components of the epidermis and dermis and signaling pathways involved in skin homeostasis.

The need of the hour is to explore the underlying mechanisms behind these complex interactions in order to produce more reliable and reproducible results of these treatments

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