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Effect of Mesenchymal Stem Cell Conditioned Media on Fibroblasts: Implications for Skin Regeneration and Wound Healing

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Introduction

Stem cell-based therapies show great promise in regenerative medicine, with bone marrow-derived mesenchymal stem cells (BM-MSC) being particularly noteworthy for their high multilineage differentiation and paracrine signaling. MSC, derived from sources like cord blood, adipose tissue and bone marrow, are multipotent cells capable of differentiating into various tissues as well as known for their regenerative and immunomodulatory properties. Conditioned media from MSC (MSC-CM), rich in bioactive factors, offers a practical therapeutic alternative, reducing immune reactions and ensuring consistent effects. MSC-CM has shown promise in wound healing, skin rejuvenation, and other skin applications. In this study, we investigated the effects of BM-MSC-CM on human dermal fibroblasts (HDFs), focusing on their proliferation, migration, and the promotion of collagen and elastin synthesis. The research underscores the potential of BM-MSC-CM in developing safer, more effective regenerative therapies for skin applications including skin regeneration, wound healing and anti-aging.

Methods

Flow cytometry evaluated BM-MSC markers using antibodies for CD73, CD105, CD90 and CD34, CD45. BM-MSC-conditioned media (CM) was prepared by centrifuging and filtering media collected after 48 hours. Superficial and deep tissue dermal fibroblasts were treated with 5%, 10%, and 20% BM-MSC-CM. Proliferation was assessed with Alamar Blue. Migration was measured using a scratch wound healing assay in confluent fibroblasts in 6-well plates, with healing observed and analyzed using ImageJ from day 0 to 3. Collagen content was measured using Condrex Sirius Total Collagen Kit, and elastin content was measured using Fastin Kit.

Results

Flow cytometry results showed BM-MSC demonstrate the expected phenotype for human MSC (highly positive expression of CD105, CD73, CD90, and negative expression of CD34 and CD45). The Alamar Blue assay demonstrated that BM-MSC-CM significantly improved proliferation of fibroblasts compared to the control conditioned media. The scratch wound healing assay revealed that BM-MSC-CM at 5%, 10%, and 20% enhanced migration of fibroblasts (resulted in closure of the gap) with respect to control.

Conclusions

This study demonstrated the remarkable potential of BM-MSC-CM for enhancing the functional properties of HDFs, which are crucial for skin regeneration and wound healing. However, further studies are needed to evaluate/identify the key bioactive factors in BM-MSC-CM as well as their effects on skin tissue repair and wound healing in vivo.

References

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