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Mesenchymal Stem/Stromal Cells

THERAPEUTIC EFFECTS OF CONDITIONED MEDIUM FROM HUMAN UMBILICAL CORD MESENCHYMAL STEM CELLS WITH/WITHOUT DEFEROXAMINE-PRECONDITIONING ON THE SEVERE TYPE 1 DIABETES MODEL IN RATS

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Keywords: Type 1 Diabetes, Conditioned Medium, Deferoxamine.

Background & Aim: Type 1 diabetes (T1D) is a T-cell-mediated autoimmune disease characterized by the irreversible destruction of pancreatic β-cells. Impaired T-cell balance and cytokine production play a synergistic role in β-cell destruction, resulting in insulin deficiency and hyperglycemia. Mesenchymal stem cells (MSC) are a perfect therapeutic tool for autoimmune diseases with their antiapoptotic, antioxidant, immunomodulatory, and immunosuppressive properties. The cells perform these functions paracrinely with the factors they secrete. Considering the disadvantages of cell therapies, it has become important to exploit their therapeutic properties by using the secretomes of MSCs. Conditioned medium (CM) refers to the culture medium in which the cells grow and contains whole secretomes. Inducing cells with external stimuli such as hypoxia could enhance the therapeutic potency of CM by modifying the secretomes of MSCs. Therefore, this study aims to evaluate the therapeutic effects of CM obtained from MSCs preconditioned with a hypoxia mimetic agent, deferoxamine (DFS-CM), on the T1D model by comparing it with CM obtained from normal MSCs (N-CM).

Methods, Results & Conclusion: The isolation and characterization of MSCs from the human umbilical cord and the preparation of N-CM and DFS-CM were performed as we described previously. CMs were administered to T1D-induced rats within a treatment plan. At the end of the experimental process the effects of CMs on T1D were evaluated in the context of the Treg population, cytokine levels, pancreatic islet morphology, and β-cell regeneration. According to the results, CM applications increased the Treg population, which is critical for regulating cytokine production and T-cell balance, impaired in the T1D pathogenesis. This increase was statistically significant in the DFS-CM group. With the induction of T1D, peripheral cytokines reached measurable levels and CM treatments increased IL4 and IL10 levels while decreasing IL17 ang IFNγ. The pancreatic sections of the diabetes groups have shown that the islet size was diminished, its borders and reticular fiber organization were disturbed, and β-cells were reduced dramatically. There was a slight increase in NKX6.1-positive cells following CM treatments, but insulin-positive areas were significantly higher in the DFS-CM group. In conclusion, while using N-CM could not show a sufficient effect on T1D, the positive outcomes of DFS-CM in regulating the autoimmune mechanism and β-cell regeneration were demonstrated.

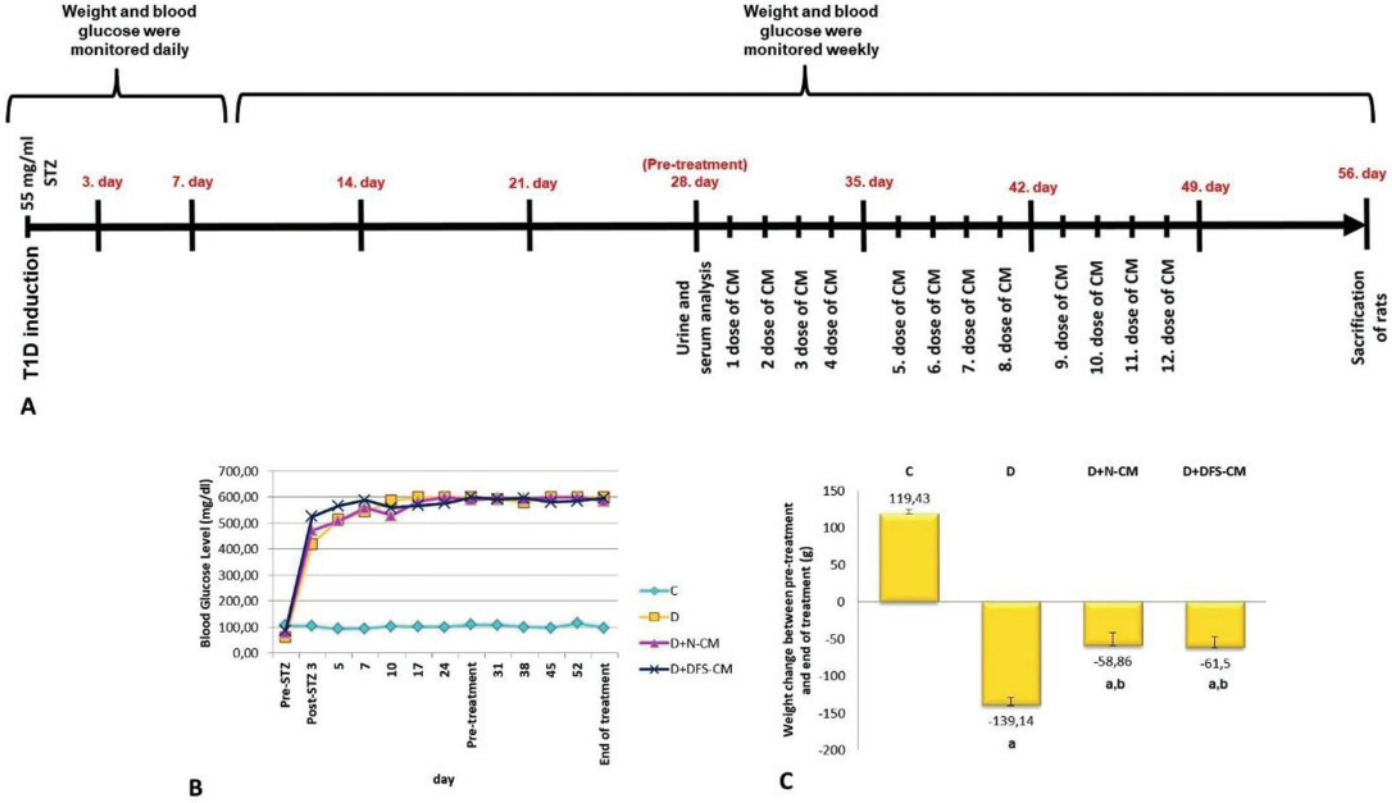

Fig. 1 (abstract 235). A) Timeline of disease modeling and treatment process. B) Mean blood glucose levels of the animals during the experiment period (n=7). C) Weight change of the animals between 1st week and 8th week(g). ap<0.001 versus the C group, bp<0.001 versus the C group. Data are presented as mean ± SEM (n=7).

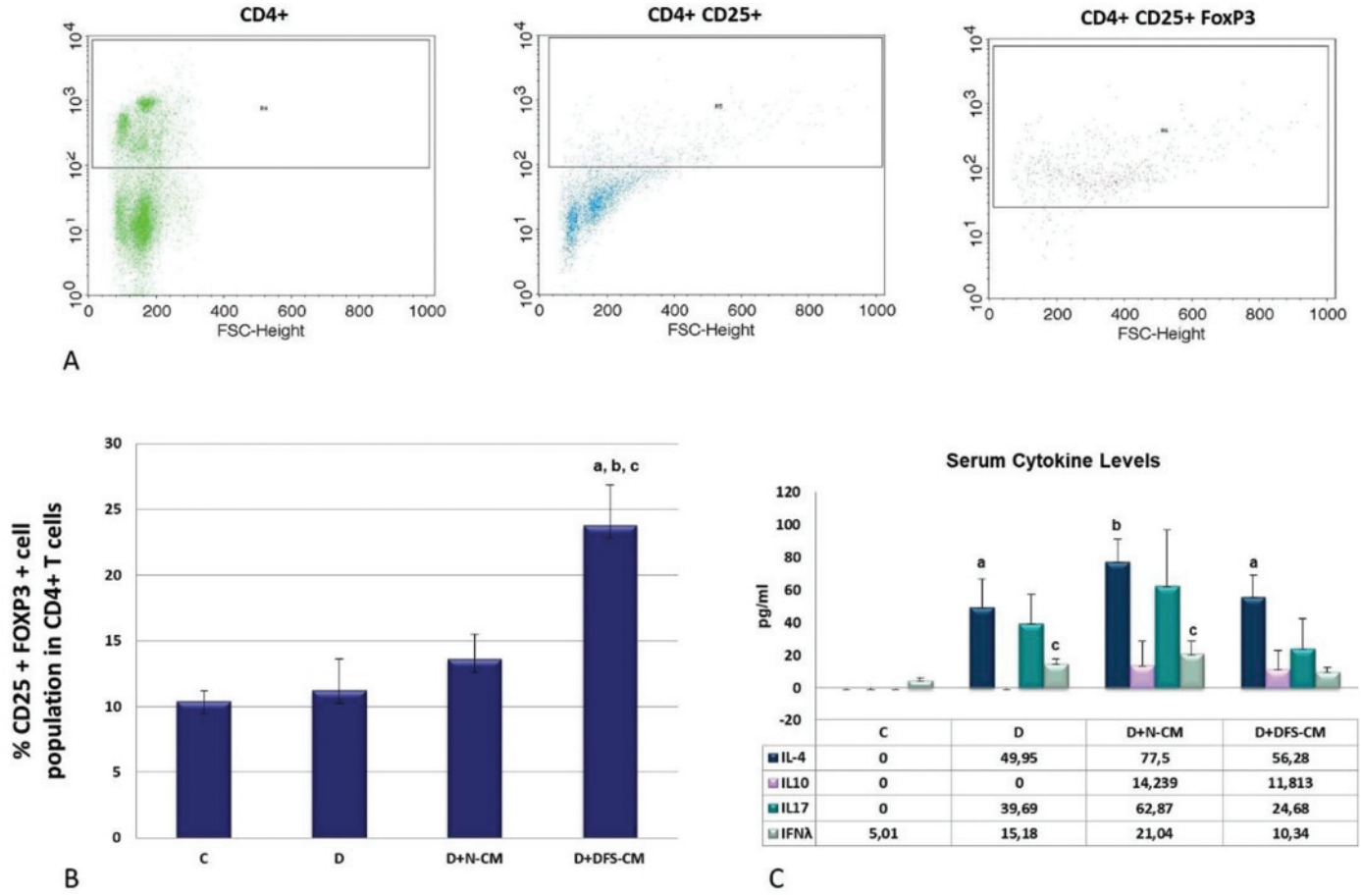

Fig. 2 (abstract 235). Treg and cytokine analysis. A) Representative dot blots showing the CD4+ CD25+FoxP3 cell population in lymphocytes isolated from the spleen. B) Percentage of CD25+ Foxp3+Treg in the CD4+ lymphocytes isolated from the spleen. ap<0.01 versus the C group, bp<0.01 versus the D group, cp<0.05 versus the D+N-CM group. Data are presented as mean ± SEM (n=6). C) Cytokine levels of the groups. ap<0.05 versus the C group, bp<0.001 versus the C group, cp<0.05 versus the C group. Data are presented as mean ± SEM (n=7).

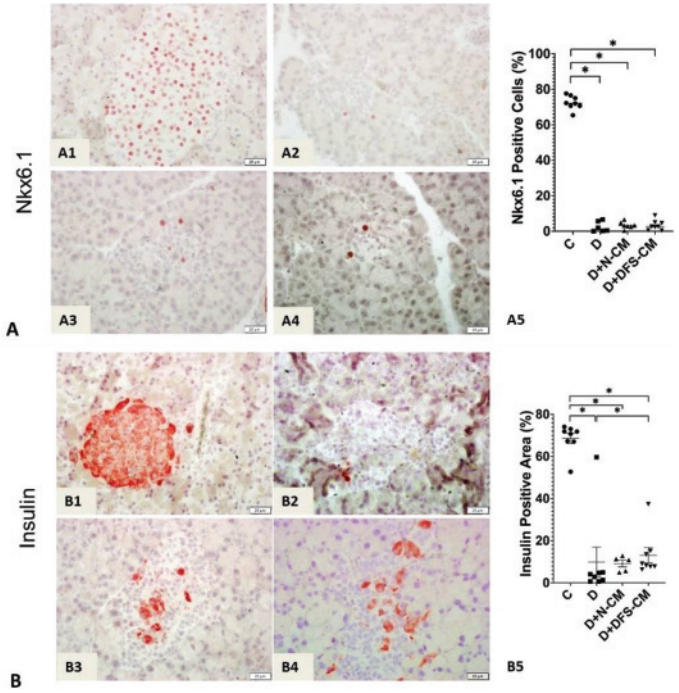

Fig. 3 (abstract 235). Immunohistochemical analyzes for Nkx6.1 and insülin. A1) C group, A2) D group, A3) D+N-CM group, A4) D+DFS-CM group. 40×. A5) Percentage of the Nkx6.1-positive cells in the islets, *p<0.05. B1) C group, B2) D group, B3) D+N-CM group, B4) D+DFS-CM group. 40×. B5) Percentage of insulin positivity in the islet, *p<0.05.

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Mesenchymal Stem/Stromal Cells

FAR-INFRARED IRRADIATION EMITTED FROM CARBON FIBER SHEETS INCREASES OSTEOGENIC DIFFERENTIATION OF HUMAN TONSIL-DERIVED MESENCHYMAL STEM CELLS

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Keywords: tonsil-derived mesenchymal stem cells, far-infrared, osteogenesis.

Background & Aim: Far-infrared (FIR) is an electromagnetic radiation spectrum subdivided into 3–1000 μm, as defined by the International Commission on Illumination. FIR irradiation exerts various biological effects on cellular activities. Our previous study demonstrated that FIR induces osteogenesis of MSCs but inhibits adipogenesis, suggesting its potential therapeutic implication for treating osteoporosis, which is caused by an imbalance between osteogenic and adipogenic differentiation of MSCs in the bone marrow. Based on this finding, we attempted to devise a new tool that makes FIR irradiation more comfortable for clinical application.

Methods, Results & Conclusion: Recently, we have designed the carbon fiber sheets (CFS) planar heating element device, which is com-