ulate the microenvironment in the facial nerve nucleus but also repair the facial neurons themselves. The high neuronal survival rates in the co-transplantation groups might be due to the fact that condition is beneficial for its survival and differentiation, which also promotes the secretion of BDNF. After the FNA, inflammatory cytokines and/or neural growth factors might be produced in the facial nerve nucleus to activate the microglia, astrocytes, and peripheral immune cells around the FMN. The activated cells interact with the facial nerve neurons to change the gene expression in the nucleus, to provide the essential survival factors for the facial neurons, promoting the cell survival, axon regeneration, and fragment connection.[19,20] The activated astrocytes could produce the neural growth factors, and activated microglia could secrete the excitatory neurotransmitters to deliver the signal to the motor nerve, thereby transforming the injured facial neuron synapses from the neurotransmitter transferring mode to the regenerative mode.[20] Neuronal survival provides the foundation of functional repair after the FNA. BMSCs can differentiate into neuron-like cells or neural stem cells in the microenvironment in the central nervous system. Moreover, due to the local hypoxia or lack of blood flow, the BMSC survival rate is somehow decreased. Co-culture of BMSCs and monocytes could inhibit the proliferation of monocytes, and increase the proportion of Treg cells, thereby improving the survival microenvironment for BMSCs and elevating the survival rate.

In conclusion, our results suggest that the co-transplantation of BMSCs and monocytes (BMSCs: monocytes = 1:30) could significantly improve the environment in the facial nerve nucleus, promoting the anti-/pro-inflammatory balance shift towards the anti-inflammatory microenvironment, alleviating the survival conditions for BMSCs, regulating the chemotaxis, homing, differentiation, and section of BMSCs, and finally reducing the neuronal apoptosis. These findings might provide essential evidence for the in-hospital treatment of FNA with co-transplantation of BMSCs and monocytes.

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