Collagen Modulates the Biological Characteristics of WJ-MSCs in Basal and Osteoinduced Conditions

ABSTRACT

Transcriptomic analysis revealed mesenchymal stem/stromal cells (MSCs) from various origins exhibited distinct gene and protein expression profiles dictating their biological properties. Although collagen type 1 (COL) has been widely studied in bone marrow MSCs, its role in regulating cell fate of Wharton jelly- (WJ-) MSCs is not well understood. In this study, we investigated the effects of collagen on the characteristics of WJ-MSCs associated with proliferation, surface markers, adhesion, migration, self-renewal, and differentiation capabilities through gene expression studies. The isolated WJ-MSCs expressed positive surface markers but not negative markers. Gene expression profiles showed that COL not only maintained the pluripotency, self-renewal, and immunophenotype of WJ-MSCs but also primed cells toward lineage differentiations by upregulating BMP2 and TGFB1 genes. Upon osteoinduction, WJ-MSC-COL underwent osteogenesis by switching on the transcription of BMP6/7 and TGFB3 followed by activation of downstream target genes such as INS, IGF1, RUNX2, and VEGFR2 through p38 signalling. This molecular event was also accompanied by hypomethylation at the OCT4 promoter and increase of H3K9 acetylation. In conclusion, COL provides a conducive cellular environment in priming WJ-MSCs that undergo a lineage specification upon receiving an appropriate signal from extrinsic factor. These findings would contribute to better control of fate determination of MSCs for therapeutic applications related to bone disease.