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Mesenchymal stem cell-conditioned medium promotes vascularization of nanostructured scaffold transplanted into nude mice: a morphological study

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Human adult mesenchymal stem cells have mainly been studied in the past decade due to their multilineage differentiation and potential use in many cell-based therapies. However, in the last few years, there has been a growing body of evidence suggesting that the role of hMSCs in tissue regeneration is mainly due to their secretion of pro-angiogenic, anti-apoptotic and antiinflammatory factors known as a paracrine effect. The increasing evidence showing the potential of hMSC secretome has led to the acknowledgement that the use of hMSC conditioned medium may represent a valid alternative to the use of stem cells, overcoming the main obstacles related to cell sample handling survival and rejection. Accordingly, this study focuses on the characterisation and in vivo application of hMSCs conditioned medium (CM). To this aim, hMSCs have been isolated from two different sources, adipose tissue (hASCs) and dental pulp (hDPSCs). Although hASCs have been largely studied, very few is known about hDPSCs. Therefore, hDPSCs have been characterised by FACS, qPCR and immunofluorescence up to their 30th passage to confirm their stemness maintenance over long culture. hASCs and hDPSCs CMs, obtained after 72h of starvation in both normoxic and hypoxic conditions, have been concentrated and characterised by ELISA to evaluate the effect of hypoxia on the release of proangiogenic factors. To compare the pro-angiogenic potential of hMSC secretome vs the cells, the hASCs and hDPSCs CMs, obtained in normoxic conditions, have been mixed with a collagen scaffold, INTEGRA® Flowable Wound Matrix, and grafted in BALB-C nude athymic mice for 28 days. Even though an exhaustive characterisation of the conditioned culture medium, which also includes the microvesicle fraction, is still in progress, the data obtained demonstrated that Integra® FWM associated with CM showed the same efficiency as Integra® FWM related to cells in promoting cellular invasion and capillary growth. This encourages the cell-free approach for damaged tissue regeneration.

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