Advances in efficient microfluidic cell sorting based on filterless hydrodynamic filtration

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As the continuous cell sorting into each subpopulation, we performed flow-based sorting of human bone marrow-derived mesenchymal stem cells (hMSCs) by using optimally designed microfluidic chips based on the hydrodynamic filtration (HDF) principle. Sorting out a specific hMSC subpopulation with high self-renewal and multipotent capacities is a useful approach to enhance effectiveness of cell therapy. In this study, three subpopulations were set: rapidly self-renewing (<23 micron), spindle-shaped, and flattened (>35 micron) cells. To further improve sorting efficiency and throughput, a spiral channel in the upper layer designed for inertial focusing by Dean flow was coupled with the lower HDF layer. Sorting efficiency has been compared to the result obtained by the fluorescence activated cell sorter (FACS) to validate our method, and recovery and purity over 90% were achieved higher than those of previous results. Our method was confirmed by reverse transcription-PCR (RT-PCR) analysis and alkaline phosphatase staining for osteogenic differentiation. The HDF is also possible to apply to the size and deformability-based separation of islets from exocrine acinar tissue.