

## Stem cell technology using bioceramics: hard tissue regeneration towards clinical application

### REVIEW ARTICLE

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**Abstract** Mesenchymal stem cells (MSCs) are adult stem cells which show differentiation capabilities toward various cell lineages. We have already used MSCs for treatments of osteoarthritis, bone necrosis and bone tumor. For this purpose, culture expanded MSCs were combined with various ceramics and then implanted. Because of rejection response to allogeneic MSC implantation, we have utilized patients' own MSCs for the treatment. Bone marrow is a good cell source of MSCs, although the MSCs also exist in adipose tissue. When comparing osteogenic differentiation of these MSCs, bone marrow MSCs show more extensive bone forming capability than adipose MSCs. Thus, the bone marrow MSCs are useful for bone tissue regeneration. However, the MSCs show limited proliferation and differentiation capabilities that hindered clinical applications in some cases. Recent advances reveal that transduction of plural transcription factors into human adult cells results in generation of new type of stem cells called induced pluripotent stem cells (iPS cells). A drawback of the iPS cells for clinical applications is tumor formation after their *in vivo* implantation; therefore it is difficult to use iPS cells for the treatment. To circumvent the problem, we transduced a single factor of either *SOX2* or *NANOG* into the MSCs and found high proliferation as well as osteogenic differentiation capabilities of the MSCs. The stem cells could be combined with bioceramics for clinical applications. Here, we summarize our recent technologies using adult stem cells in viewpoints of bone tissue regeneration.

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