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Boron enhances odontogenic and osteogenic differentiation of human tooth germ stem cells (hTGSCs) in vitro

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Abstract

Stem cell technology has been a great hope for the treatment of many common problems such as Parkinson's disease, Alzheimer's disease, diabetes, cancer, and tissue regeneration. Therefore, the main challenge in hard tissue engineering is to make a successful combination of stem cells and efficient inductors in the concept of stem cell differentiation into odontogenic and osteogenic cell types. Although some boron derivatives have been reported to promote bone and teeth growth in vivo, the molecular mechanism of bone formation has not been elucidated yet. Different concentrations of sodium pentaborate pentahydrate (NaB) were prepared for the analysis of cell toxicity and differentiation evaluations. The odontogenic, osteogenic differentiation and biomineralization of human tooth germ stem cells (hTGSCs) were evaluated by analyzing the mRNA expression levels, odontogenic and osteogenic protein expressions, alkaline phosphatase (ALP) activity, mineralization, and calcium deposits. The NaB-treated group displayed the highest ALP activity and expression of osteo- and odontogenic-related genes and proteins compared to the other groups and baseline. In the current study, increased in vitro odontogenic and osteogenic differentiation capacity of hTGSCs by NaB application has been shown for the first time. The study offers considerable promise for the development of new scaffold systems combined with NaB in both functional bone and tooth tissue engineering.

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