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The effect of oxygen tension on the in vitro assay of human osteoblastic connective tissue progenitor cells.

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Connective tissue progenitors (CTPs) are defined as the heterogeneous set of stem and progenitor cells that reside in native tissues and are capable of proliferation and differentiation into one or more connective tissue phenotypes. CTPs play important roles in tissue formation, repair, and remodeling. Therefore, in vitro assays of CTP prevalence and biological potential have important scientific and clinical relevance. This study evaluated oxygen tension as an important variable in optimizing in vitro conditions for quantitative assays of human CTPs. Bone marrow aspirates were collected from 20 human subjects and cultured using established medium conditions at ambient oxygen tensions of 1, 5, 10, and 20%. Colony-forming efficiency (CFE), proliferation, and colony density were assessed. CFE and proliferation were greatest at 5% O(2). Traditional conditions using atmospheric oxygen tension (20% O(2)) reduced CFE by as much as 32%. CFE and proliferation at 1% O(2) were less than 5% O(2) but comparable to that seen at 20% O(2), suggesting that CTPs are relatively resilient under hypoxic conditions, a fact that may be relevant to their function in wound repair and their potential use in tissue engineering applications involving transplantation into settings of moderate to severe hypoxia. These data demonstrate that optimization of quantitative assays for CTPs will require control of oxygen tension. (c) 2008 Orthopaedic Research Society.