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Original Contribution

CULTURING PERIOSTEUM IN VITRO: THE INFLUENCE OF DIFFERENT SIZES OF EXPLANTS

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☐ **Abstract — Periosteal transplantation is being used clinically to repair articular defects. Isolated cells and very small periosteal explants can be grown in tissue culture, but it will be necessary to test larger sizes for tissue engineering to be applied to clinical transplantation of periosteum. This study was conducted to assess the chondrogenic potential of different sizes of periosteal explants in agarose culture. Ninety-six rabbit tibial periosteal explants in three different sizes (small 1.5 × 2, medium 3 × 2, and large 4 × 6 mm, 32 pieces per size) were cultured in agarose suspension for 6 wk and given TGF-β1 (10 ng/mL) for the first 2 wk. Tissue growth, as indicated by normalized final wet weights of the explants after 6 wk in culture, was inversely proportional to explant size. Cartilage formation was observed in all explants. Histomorphometry revealed that cartilage formation was significantly better for the smaller explants (80% cartilage), but similar in the medium and larger explants (60% cartilage). Similar proportions of type II collagen were present in the different-sized explants. This study demonstrates that various sizes of periosteal explants can be grown in culture. Abundant cartilage was produced even by the large explants. © 1998 Elsevier Science Inc.**

☐ **Keywords — Articular cartilage; Repair; Regeneration; Periosteum; Chondrogenesis; Tissue engineering; Explants.**

INTRODUCTION

The rapidly growing interest in cell and tissue transplantation for cartilage repair stems from the well-recognized fact that damaged articular cartilage is incapable of healing itself (2,3,7,11,12,15–17,21,25,30).

Cartilage regeneration has been shown to be possible in experimental animals (21,22,25,27–29) and human patients (1,6,9,10,13,19) by whole tissue transplantation using periosteum or perichondrium, which contain undifferentiated mesenchymal stem cells that have the potential to form cartilage or bone (8,18,23,32). The results are not always predictable, which has led to development of in vitro models that should help us to better understand the process of chondrogenesis. These usually involve the study of isolated cells or very small explants (8,14,18,23,32). Cells do not necessarily behave the same in vitro as their normal environment in vivo; therefore, whole tissue organ models have some theoretical advantages. We have developed and extensively documented an organ culture model for studying chondrogenesis in whole periosteal explants in vitro, but the costs and number of sacrificed animals involved make it necessary that we employ small explants (8,18,23). Whether or not the response of small tissue explants used in the vitro model would differ from that of larger ones, and their relative chondrogenic potentials, are unknown. For these reasons, it will be necessary to test larger explant sizes not only to validate our model, but also for tissue engineering to be applied to clinical transplantation of periosteum.

This study was conducted to assess the chondrogenic potential of different sizes of periosteal explants in agarose culture.

MATERIALS AND METHODS

Periosteal explants were obtained from a total of 30 2-mo-old White New Zealand rabbits weighing an average of 1.75 kg each. All animals were sacrificed by lethal injection of sodium pentobarbital. The medial legs were

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