The Effect of Platelet Rich Plasma and Hyaluronic Acid on Autologous Osteochondral Transplantation: an in vivo Rabbit Model

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Introduction: Autologous osteochondral transplantation (AOT) is a surgical treatment strategy that has been used to treat osteochondral lesions (OCL). However, known concerns of the technique is the histological degradation the graft undergoes following harvesting and implantation trauma, as well as its poor incorporation at the cartilage interface. Biological adjuncts, including platelet-rich plasma (PRP) and hyaluronic acid (HA) have been described has having the potential to improve the results of cartilage repair treatment strategies. The purpose of this study was to assess the effect of PRP and HA individually, as well as combined, on the histological results of AOT in a rabbit model.

Methods: Bilateral osteochondral defects (2.7 mm in diameter, 5 mm in depth) were created on the lateral femoral condyles of 36 New Zealand White rabbits. These defects were substituted with osteochondral grafts harvested from the contralateral femoral condyle and following wound closure and after randomization, the knees were treated with either the biological adjunct (PRP group, n = 12; HA group, n = 12; PRP + HA group, n = 12) or saline solution (control) with each rabbit serving as its own control. The rabbits were euthanized at three, six, or twelve weeks postoperatively. The osteochondral graft sections were stained using hematoxylin and eosin, alcian blue, and type II collagen immunohistochemistry and assessed using the modified International Cartilage Repair Society (ICRS) scoring system. As the results were not normally distributed, the variables were evaluated using the Wilcoxon signed-rank test.

Results: The mean modified ICRS histological score for the PRP treated group was significantly higher than its control (18.2 + 2.7 versus 13.5 + 3.3; p = 0.002). The mean modified ICRS histological score for the HA treated group showed no statistically significant difference compared to its control (15.9 + 2.9 versus 14.5 + 3.6; p = 0.142). The mean modified ICRS histological score for the PRP + HA treated group was significantly higher than its control (17.9 + 2.6 versus 14.0 + 3.3; p = 0.006). There was no statistically significant difference between the mean modified ICRS scores of the PRP and the PRP + HA treated grafts (p = 0.445). Assessing graft integration specifically, the mean score of the PRP and PRP + HA treated groups was significantly higher than that of their controls (PRP, p = 0.004; PRP + HA, p = 0.011), however there was no statistically significant difference in the integration scores between the PRP and PRP + HA groups (p = 0.328). No adverse events occurred as a result of the surgical procedure, or PRP and HA administration.

Discussion: PRP improved the integration of the osteochondral graft at the cartilage interface and improved the modified ICRS histological score in an in vivo animal model. HA did not significantly affect the histological results of AOT either on its own, or as an addition to PRP.

Significance: PRP may have the potential to improve the clinical outcomes of autologous osteochondral transplantation.

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