

Hyperbaric Oxygen Therapy Enhances Graft Healing and Mechanical Properties after Anterior Cruciate Ligament Reconstruction: An Experimental Study in Rabbits

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INTRODUCTION: Hyperbaric oxygen therapy (HBOT) has proven successful in wound healing. However, its potential effects on anterior cruciate ligament (ACL) injuries remain uncertain. This study aimed to investigate the effect of HBOT on graft healing following ACL reconstruction in rabbits.

METHODS: Male New Zealand rabbits underwent ACL reconstruction and were randomly divided into two groups: the HBOT group and the ambient air group. The HBOT group received 100% oxygen at 2.5 atmospheres absolute for 2 hours daily for 5 consecutive days, starting from the first day after surgery. The ambient air group was maintained in normal room air throughout the entire period. After 12 weeks following the surgery, animals were euthanized, and their knees were collected for analyses. Magnetic resonance imaging was used to evaluate graft signal and tunnel size; high-resolution peripheral quantitative computed tomography was performed to assess bone mineral density and microarchitecture parameters. Load to failure and stiffness of the graft were evaluated by biomechanical analysis.

RESULTS: The HBOT group demonstrated superior graft maturation and integration in comparison to the ambient air group, as verified by lower graft signal intensity, decreased femoral and tibial tunnel size, and higher bone mineral density values. In addition, biomechanical analysis indicated that the HBOT group had greater load to failure and stiffness than the ambient air group.

DISCUSSION AND CONCLUSION: The adjuvant use of HBOT improved graft healing after ACL reconstruction in rabbits. This study provides important insights into the potential clinical application of HBOT as a therapeutic intervention to enhance graft healing after ACL reconstruction. Further studies are needed to evaluate the impact of HBOT on human subjects.

