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Tissue engineering repair strategies to patch the annulus fibrosus

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Abstract

Degenerative disc disease (DDD) is a prevalent condition in our society and billions of dollars are spent annually to treat patients for the chronic pain associated with this ailment.¹ The lower back pain experienced by DDD is due to a rupture in the outer annulus fibrosus of an intervertebral disc (IVD), typically in the lumbar discs, causing the jelly-like nucleus pulposus to escape from the centre of the disc and inflames the spinal nerves.² Advances in tissue engineering are beginning to develop a novel method to treat this condition by applying a patch to the annulus that allows for cartilage formation and integration resulting in repair of the degenerated disc. For this study, two different methods were used to fabricate a hydrogel. The first method used fibrinogen and thrombin dissolved in PBS that formed a gel before genipin dissolved in DMEM was used to cross-link.³ The second method of fabrication used all reagents dissolved in DMEM, and the genipin was allowed to cross-link with the fibrinogen before thrombin was added to form the gel.⁴ The two methods were compared via degradation to determine their stability in conditions similar to those experienced by native IVDs. The results of the degradation in PBS showed that the first method of fabrication allowed the gels to last until day 10 before completely dissolving. The gels made using the second fabrication method dissolved by day 3. There was no significant difference on the degradation characteristics due to varying the concentration of genipin. This first method was selected to perform a cell-mediated degradation with human bone marrow mesenchymal stem cells (hbm-MSCs) that formed gels that lasted over 20 days. These results suggest that genipin cross-linked fibrin gels seeded with hbm-MSCs produce a stable gel with the potential to be used to repair a damaged IVD.

References

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