

IMPROVING TENDON REPAIR: THE USE OF HUMAN AMNIOTIC MEMBRANE SEEDED WITH TENOGENIC MESENCHYMAL STEM CELLS IN A RAT MODEL

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Introduction: Tendon repair poses a challenge because of its hypocellularity and tendency to form adhesions. This study investigated the effect of human amniotic membrane (HAM) on adhesion formation. We also evaluated the influence of undifferentiated mesenchymal stem cells (MSCs) and tenogenically-differentiated mesenchymal stem cells (tMSCs) on tendon healing.

Methodology: The study involved 231 Sprague-Dawley rats. 15 rats were sacrificed for MSC isolation. Achilles tendons of the remaining 216 rats were transected, and repaired by modified Kessler. The repaired tendons were divided into 4 groups: (1) Suture group: suture repair only, (2) Suture+HAM group: repair site wrapped with acellular HAM, (3) HAM+MSC group: repair site wrapped with HAM seeded with undifferentiated MSCs, (4) HAM+tMSC group: repair site wrapped with HAM seeded with tenogenic MSCs. Achilles tendons were harvested at 3, 6 and 9 weeks post-repair. Severity of adhesions were assessed, repair site graded by histological analysis, and cell-density analysis performed.

Results: Groups with HAM had significantly less adhesions compared to the group without HAM at 6 and 9 weeks post-repair. There was little difference in adhesion formation within the groups utilising HAM, regardless of whether group had been treated with acellular HAM, HAM seeded with MSCs or tMSCs. At week 3, tendons treated with tMSCs exhibited characteristics of mature tendon, compared to immature, healing tendons seen in other groups. At week 6, HAM+tMSC group still scored higher in terms of maturity than HAM+MSC group ($p < 0.01$), though the difference was no longer significant at week 9.

Conclusion: HAM reduces adhesion formation in tendon repair, but this effect is not enhanced by addition of MSCs or tMSCs. Application of tMSCs encourages early tendon maturation. Further work is needed to determine whether this accelerated tendon healing can improve overall outcome of tendon repair.