**Table 5:** Synthetic cell-based meniscal engineering

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| **Material** | **Model** | **Cells** | **Growth Factors** | **Follow-up** | **Results** | **Ref** |
| ***In Vivo*** |  |  |  |  |  |  |
| **Injectable** | |  |  |  |  |  |
| Calcium alginate gel | Caprine | BM MSCs | Cells transfected with IGF-1 | 4, 8, 16 weeks | Integration and formation of white and tenacious tissue. Chondrocyte-like cells present. Collagen I present. | 133 |
| **Self-assembled** | |  |  |  |  |  |
| Agarose wells | Bovine | 50:50 articular chondrocytes and fibrochondrocytes, 2.3x107 cells |  | 8 weeks | Anatomically relevant collagen fibre orientation. Biomechanically anisotropic tissue developed. Presence of collagen I and II, and GAGs. | 94 |
| Agarose wells | Bovine | 50:50 co-culture of fibrochondrocytes and chondrocytes, 2.75x107 cells each |  | 4 weeks | Presence of collagen I and II, and GAGs. | 156 |
|  |  | 5.5x107 fibrochondrocytes |  |  | Presence of collagen I and GAGs. Significant contracture of construct. |  |
| **Polymers** | |  |  |  |  |  |
| PGA | Murine | 2.5x107 bovine fibrochondrocytes per mL |  | 16 weeks | Presence of collagen and proteoglycan. Matrix architecture similar to meniscal repair tissue. | 159 |
| PGA | Murine | 2x107 bovine fibrochondrocytes per cm3 |  | 8 weeks | Presence of collagen and proteoglycan. Less extensive collagen network than normal meniscus. | 127 |
| PGA-PLGA | Leporine | 2x106 meniscal cells per scaffold | - | 6, 10 weeks | Fibrocartilage present. Collagen and proteoglycan content increased with time. Degeneration of tibial cartilage. | 121 |
| PLGA | Canine | 1.5x107 canine myoblasts per scaffold | CDMP-2, TGF- β1 | 12 weeks | Good integration to native tissue. Fibrocartilage formation with hyaline-like regions with collagen I, II and aggrecan production. | 119 |
| PCL-Hyaluronan | Ovine | 4x107 autologous chondrocytes per scaffold | - | 12 months | Osteoarthritis present in all groups. Less severe in scaffold groups. Foreign body reactions present. Hyaline-like matrix production in cell seeded constructs, with fibrous, GAG-rich matrix production in unseeded constructs. | 160 |
| ***In Vitro*** |  |  |  |  |  |  |
| Agarose | Leporine | 2.5x107 fibrochondrocytes per cm3 | TGF-β1 | 3 weeks | Cell death; individual cells of rounded morphology. Aggregate modulus = ~10 kPa. | 120 |
| Alginate | Bovine | 50x106 meniscal cells per mL | - | 4-6 weeks | Increase of collagen bundle size with loading. Increase in GAG content with loading however this plateaued except for in samples loaded then left static for 4 weeks where GAG plateaued after 2 weeks and sharply rose after 6 weeks. Equilibrium modulus of samples increased with extended loading. | 161 |
| **Polymers** | |  |  |  |  |  |
| PGA | Leporine | 5x107 fibrochondrocytes per cm3 |  | 7 weeks | Cellularity increased; presence of collagen and GAGs. Aggregate modulus = 2.6 ± 0.6 kPa. | 120 |
| PGA | Leporine | 2.5x107 fibrochondrocytes per cm3 | TGF-β1 | 3 weeks | Supports cell growth and ECM production. TGF-β1 stimulated collagen and GAG synthesis. | 129 |
| PGA | Bovine | 50:50 articular chondrocytes and fibrochondrocytes, 2.3x107 |  | 8 weeks | Cell death; presence of randomly oriented collagen and GAGs. Tensile modulus = 16 ± 5 kPa in circumferential direction. | 94 |
| PGA-hyaluronan | Human | 8.8x106 meniscus derived cells per scaffold | - | 3 weeks | Increase in matrix protein expression compared to control. Decrease in collagen X expression for all groups. Suggested redifferentiation of meniscus cells by scaffold. | 126 |
| PGA-PLLA | Equine | 4x105 fibroblast-like synoviocytes per cm3 | bFGF, TGF-β1, IGF | 6 weeks | No integration of cell-scaffold construct to meniscal tissue. No measurable collagen or GAGs. | 163 |
| PCL | Human | 2.5x105 meniscus derived cells per scaffold | - | 10 weeks | Higher stiffness compared to unseeded scaffold. Reduced collagen and increased sGAG compared to native tissue. | 125 |