Shape-memory collagen scaffold

Intervertebral disc degeneration (IVDD) is a common cause of chronic low back pain (LBP) and a socioeconomic burden worldwide. Conservative therapies and surgical treatments provide only symptomatic pain relief without promoting intervertebral disc regeneration. Therefore, the clinical demand for disc regenerative therapies for intervertebral disc repair is high.

Koo et al. used a rat tail nucleotomy model to develop mechanically stable collagen-cryogel and fibrillated collagen with shape-memory for use in minimally invasive surgery for effective treatment of IVDD. The collagen was loaded with hyaluronic acid (HA) into a rat tail nucleotomy model.

The shape-memory collagen structures exhibited outstanding chondrogenic activities, having completely similar physical properties to those of a typical shape-memory alginate construct in terms of water absorption, compressive properties, and shape-memorability behavior. The treatment of rat tail nucleotomy model with shape-memory collagen-cryogel/HA alleviated mechanical allodynia, maintained a higher concentration of water content, and preserved the disc structure by restoring the matrix proteins.

According to these results, the collagen-based structure could effectively repair and maintain the Intervertebral disc matrix better than the controls, including hyaluronic acid only and shape-memory alginate with hyaluronic acid [1)]

1)
Koo YW, Lim CS, Darai A, Lee J, Kim W, Han I, Kim GH. Shape-memory collagen scaffold combined with hyaluronic acid for repairing intervertebral disc. Biomater Res. 2023 Mar 29;27(1):26. doi: 10.1186/s40824-023-00368-9. PMID: 36991502.