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Mesenchymal stem cells combined with PDRN on full-thickness rotator cuff tendon tear

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BACKGROUND
Beneficial effect of mesenchymal stem cells (MSCs) transplantation is mainly due to paracrine actions in host tissue. However, MSCs therapy has not yet completely regenerated full-thickness rotator cuff tendon tear (FTRCTT) of the shoulder.

Methods
We investigated combined effects of ultrasound (US)-guided human umbilical cord blood-derived (UCB)–MSC with polydeoxyribonucleotide (PDRN) injection in chronic FTRCTT in a rabbit model. New Zealand white rabbits (n = 24) were randomly allocated into three groups (8 rabbits per group). FTRCTT near the insertion site of the subscapularis tendon was created. Three different injectants (G1-S, 0.2 mL UCB-MSCs; G2-P1, 0.2 mL UCB-MSCs with one injection of 0.2 mL PDRN; G3-P4, 0.2 mL UCB-MSCs and weekly four injections of 0.2 mL PDRN) were injected into FTRCTT under US-guidance. We conducted gross morphologic examinations for all rabbits after they were euthanized and classified each tendon tear as complete healing, partial- or full thickness. Masson's trichrome (MT), anti-type 1 collagen antibody (COL-1), bromodeoxyuridine (BrdU), proliferating cell nuclear antigen (PCNA), anti-vascular endothelial growth factor polyclonal antibody (VEGF), and platelet endothelial cell adhesion molecule (PECAM-1) staining were performed to evaluate histological changes. Motion analysis was also performed.

Results
There were significant differences in gross morphologic changes between before injection and at four weeks after injection in all three groups. However, there were no significant differences in tendon tear size among the three groups (fig 1). Immunohistochemistry staining revealed numerous MT stained cells. COL-1 positive cell densities in G2-P1 and G3-P4 were significantly higher than those in G1-S. There was no significant difference in MT or COL-1 staining results between G2-P1 and G3-P4. There were no significant differences in PCNA staining results among the three groups(fig 2,3). On motion analysis, walking distance and fast walking time in G2-P1 and G3-P4 were significantly longer/higher than those in G1-S. There were no significant differences in walking distance or fast walking time between G2-P1 and G3-P4.

Conclusions

These results demonstrated that there was no significant difference in gross morphologic change of tendon tear between UCB-MSCs only and combination with PDRN injection in rabbit model of chronic traumatic FTRCTT. Furthermore, there were no significant differences in regenerative effects between high (0.8 mL) and low (0.2 mL) doses of PDRN.

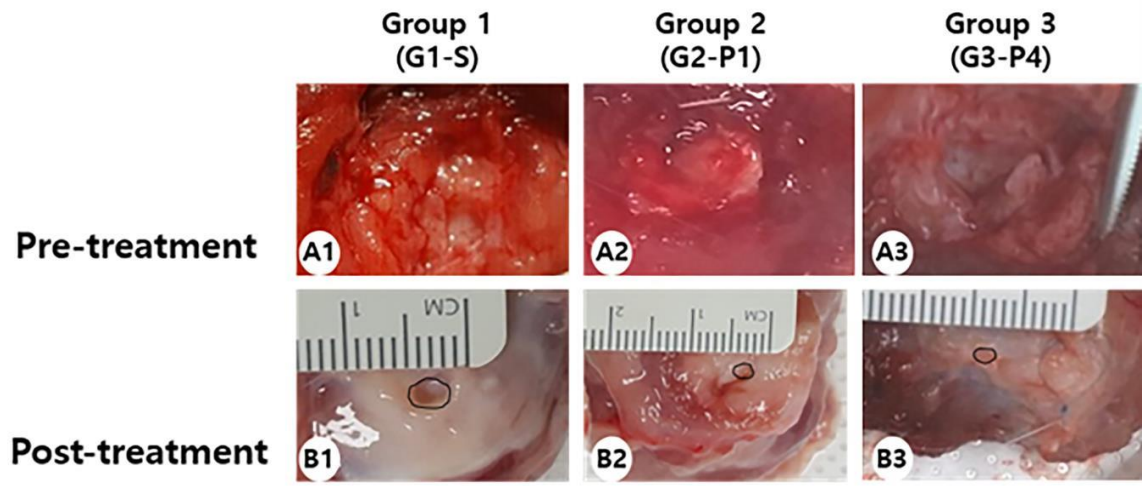

Figure 1. Gross morphological (A1-B3) findings of subscapularis tendons in groups 1, 2 and 3. (A1-A3) Pre-treatment images. FTT is observed in all three groups. (B1-B4) Post-treatment images. There were significant differences in gross morphologic changes between before injection and at four weeks after injection in all three groups.

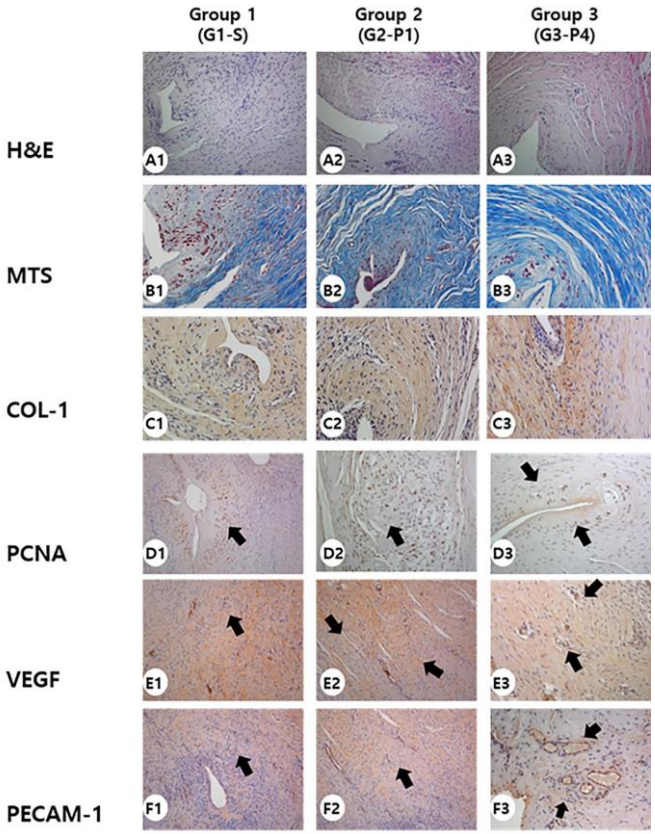

Figure 2. Histologic (A1-F3) findings of subscapularis tendons in groups 1, 2, and 3.

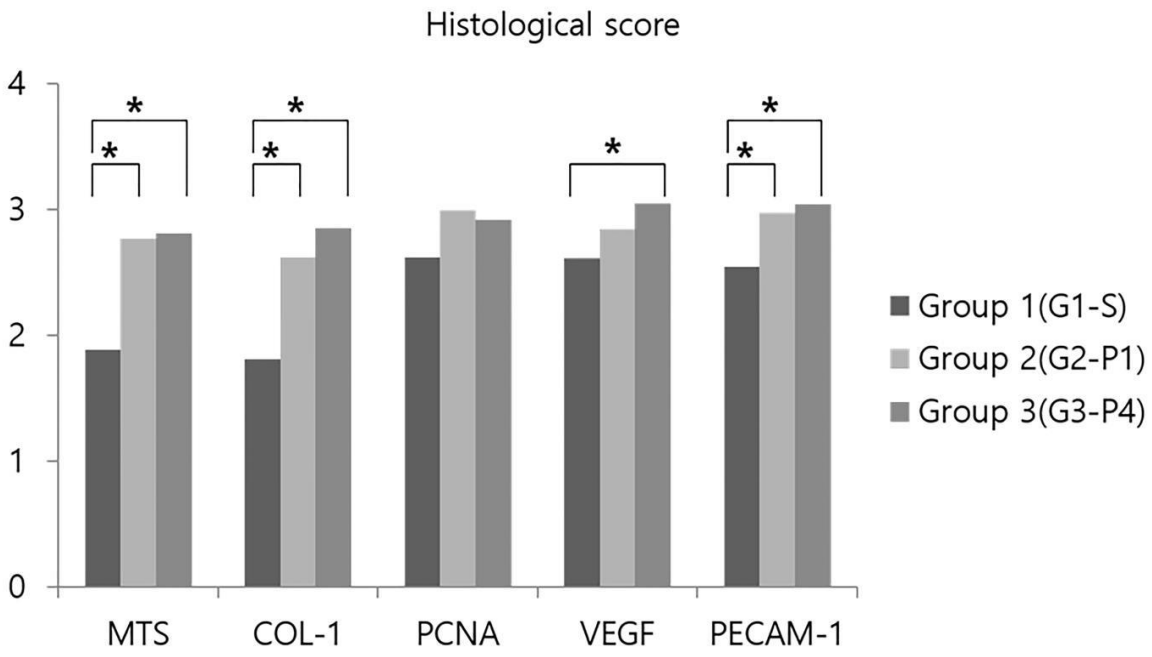

Figure 3. Semiquantitative score of histological findings for immunoreactivity of stain.