AWARD-WINNING ABSTRACTS FROM THE JAPAN SHOULDER SOCIETY ANNUAL MEETING 2020

1 EFFECTS OF AGING AND ELAPSE TIME ON MUSCLE FATTY INFILTRATION AFTER ROTATOR CUFF TEAR IN A MOUSE MODEL

Yuhei Takada[a,b], Noboru Matsumura[b], Hideyuki Shirasawa[c], Takayuki Seto[b], Ryosuke Tsujisaka[d], Takumi Nakamura[c], Keisuke Horiuchi[e], [a] Department of Orthopedic Surgery, Inagi Municipal Hospital; [b] Department of Orthopedic Surgery, Keio University School of Medicine; [c] Department of Orthopedic Surgery, Fussa Hospital; [d] Department of Orthopedic Surgery, National Hospital Organization Tokyo Medical Center; [e] Department of Orthopedic Surgery, National Defense Medical College

Background: Rotator cuff tears are one of the most common injuries in elderly orthopedic patients, and massive rotator cuff tears are often associated with progressive and irreversible muscle degeneration. This study aimed to evaluate the effect of aging and elapsed time on muscle fatty infiltration after rotator cuff tear in young and aged mice.

Methods: Young (12-week-old) and aged (50- to 60-week-old) C57BL/6 female mice were randomly divided into 2 groups, a sham surgery (control [Ctrl]) group and a "rotator cuff transection and proximal humerus resection" (RCT) group. Mice in the Ctrl group were sacrificed at 4 weeks after surgery, and the supraspinatus muscles were harvested for histological analysis. Mice in the RCT group were additionally classified into 2 groups, and the supraspinatus muscles were examined at 4 and 12 weeks after surgery.

Results: There were significant differences in the intramuscular fat area between aged mice in the Ctrl group and those in the "4 weeks after RCT" group and between aged mice in the "4 weeks after RCT" group and those in the "12 weeks after RCT" group. Fatty degeneration increased with elapsed time and was the most severe in the muscles at 12 weeks after RCT. However, no significant difference was found between young mice in the Ctrl and RCT groups.

Conclusion: The study findings show that aging and elapsed time enhance fatty degeneration of the rotator cuff muscle in mice. Aging is thought to be a major factor for easier fatty infiltration into the muscle environment after rotator cuff tear.

2 SPATIOTEMPORAL LOCALIZATION OF SCX$^+$/SOX9$^+$ PROGENITORS DURING POSTNATAL MATURATION OF THE FIBROCARTILAGINOUS ENTHESIS OF THE SUPRASPINATUS TENDON IN MICE

Katsumasa Ideo, Takuya Tokunaga, Ryuji Yonemitsu, Tatsuki Karasugi, Takeshi Miyamoto, Department of Orthopaedic Surgery, Faculty of Life Sciences, Kumamoto University, Kumamoto, Japan

Introduction: A multipotent cell population co-expressing the transcription factors Scleraxis (Scx) and SRY-box 9 (Sox9) has been shown to contribute to the formation of entheses during mouse embryonic development. Previously, fibrocartilaginous enthesis was demonstrated to form during the postnatal stage. However, whether Scx$^+$/Sox9$^+$ progenitors participate in the postnatal formation and maturation of the fibrocartilage layer is unclear. This study aimed to investigate the contribution of Scx$^+$/Sox9$^+$ progenitors to fibrocartilaginous enthesis formation by evaluating their spatiotemporal localization during the postnatal maturation of the supraspinatus tendon enthesis using *ScxGFP* transgenic mice.

Methods: Neonatal, 3-, 6-, and 20-week-old *ScxGFP* transgenic mice were euthanized. The histological morphology and localization of the Scx$^+$/Sox9$^+$ cells at the supraspinatus tendon enthesis were evaluated.

Results: In neonatal mice, no fibrocartilaginous tissue was observed in the enthesis. In 3-week-old mice, a thin fibrocartilaginous tissue without tidemarks was observed at the attachment site. In 6- and 20-week-old mice, a mature fibrocartilaginous enthesis was observed. In neonatal mice, many Scx$^+$/Sox9$^+$ cells were observed in the tendon proper of the attachment site. In 3-week-old mice, the number of Scx$^+$/Sox9$^+$ cells was reduced compared to that that in neonatal mice, and the cells were distributed at the surface of the fibrocartilage layer. In 6- and 20-week-old mice, few Scx$^+$/Sox9$^+$ cells were observed in the mature fibrocartilaginous enthesis.

Conclusion: During postnatal fibrocartilaginous enthesis formation, Scx$^+$/Sox9$^+$ cells may function as entheseal progenitor-like cells as well as during embryonic enthesis development.

3 EFFICACY OF AUGMENTATION THERAPY USING TILAPIA SCALE-DERIVED TYPE I COLLAGEN SCAFFOLDS FOR ROTATOR CUFF HEALING IN RAT MODELS

Kohei Yamaura[a], Yutaka Mifune[a], Atsuyuki Inui[a], Tomoya Yoshikawa[a], Issei Shinohara[a], Takeshi Kokubu[b], [a] Department of Orthopaedic Surgery, Graduate School of Medicine, Kobe University; [b] Department of Orthopaedic Surgery, Shin-Suma General Hospital

Background: This study aimed to evaluate the biological efficacy of augmentations using tilapia scale-derived collagen scaffolds during the early healing process of rotator cuff tears in rat models.

Methods: The infraspinatus tendon was resected from the greater tuberosity of Sprague-Dawley rats. In the control group, the tendon edge was sutured directly to the humeral head. In the augmentation group, the repaired site was augmented with a tilapia scale-derived collagen scaffold. Histological examinations were performed using safranin O and immunofluorescence staining (isolectin B4 and type II collagen) in the bone-tendon junction at 2 and 4 weeks after surgery, respectively. For mechanical analysis, the ultimate failure load of the tendon-humeral head complex was evaluated at 6 weeks postoperatively.

Results: In safranin O staining, proteoglycan staining at the repaired enthesis was greater in the augmentation group than in the control group at 4 weeks postoperatively. Vascular staining with isolectin B4 was significantly higher in the augmentation group than that in the control group at 2 and 4 weeks postoperatively. Type II collagen expression was significantly greater in the augmentation group than in the control group at 4 weeks postoperatively. The ultimate failure load was significantly higher in the augmentation group than in the control group at 6 weeks postoperatively. Discussion In this study, augmentation therapy using tilapia scale-derived type I collagen scaffolds promoted angiogenesis and fibrocartilage regeneration at the enthesis and provided higher mechanical strength than control treatment.