Influence of adhesion-related fascial gliding restrictions on dermal and articular movement

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BACKGROUND: The fascia is a connective tissue that covers the tissue of the body. It maintains the relative positions of visceral organs and skeletal muscles, comprising the frame of the inner parts of the body. Under the skin, the superficial adipose tissue, superficial fascia, deep adipose tissue, and deep fascia are present. This structure plays a role in external mechanical force absorption, facilitating skeletal muscle contractions regardless of external forces [1, 2]. The purpose of this study was to investigate the influence of adhesion-related destruction of the fascial structure on dermal and subcutaneous tissue movement.

METHODS: Ten 9-week-old Wistar rats were used. They were divided into control (n=4) and adhesion (n=6) groups. In the adhesion group, the skin to middle layer of the anterior tibial muscle was longitudinally incised on the anterior surface of the lower thigh, and sutured. After 4 weeks, dermal movement was photographed with a video camera under anesthesia. Subsequently, the movement of each subcutaneous tissue during dorsal and plantar flexion of the ankle joint was examined using ultrasonography. Then, the anterior surface of the lower thigh was extirpated, and immunofluorescence staining of anti-CD68 and anti-collagen type I was performed, followed by microscopy.

RESULTS: Dermal movement after 4 weeks was reduced, however, deep fascial showed excessive movement. Furthermore, anti-CD68-positive cells remained at the site of incision, and anti-collagen type I-positive reaction disappeared somewhere along the line.

CONCLUSIONS: In this study, we prepared an adhesion model by incising the subcutaneous tissue to anterior tibial muscle and suturing it. After 4 weeks, adhesion was present, restricting dermal movement, and fascial gliding was increased below the site of adhesion during passive articular movement. Such an imbalance in fascial gliding may promote the release of algesic substances, inducing pain, immobility, and arthrogryposis.

REFERENCES
The images of ultrasonic echo at anterior surface of leg on postoperative 4 weeks in the control group (A, B) and adhesion group (C, D). The arrowheads indicate “excessive slack” of fascia.

Representative immunofluorescence staining for anti-CD68 (red), anti-Collagen type I (green), and 4’,6-diamidino-2-phenylindole (blue) and merged images of signals from both cell markers in the control group (A) and adhesion group (B). Arrowheads indicate negative reaction of anti-collagen type I. Scale bar = 200um