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The Trapeziometacarpal Joint: A Comparison Between the DRL and AOL

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INTRODUCTION. The dorsoradial ligament (DRL) and anterior oblique ligament (AOL) have been proposed to play an important role in stabilizing the trapeziometacarpal joint (TMCJ). The primary objective of our study was to provide comparative anatomical and mechanical data on these ligaments in attempt to understand the relative importance of both ligaments in stabilizing the TMCJ.

METHODS. Thirteen thumbs from 9 fresh-frozen cadavers were used. All specimens underwent X-rays and MRI (3T Achieva, Philips Medical Systems). Length, width and thickness of the AOL and DRL were measured on MRI and/or after dissection. The first metacarpal (MC1) and trapezium (Trap) were isolated and cut sagittally to isolate a MC1-AOL-Trap and MC1-DRL-Trap complex from each thumb. These samples were subjected to cyclic loading in displacement-controlled tests. The obtained force-displacement curves were used to calculate stiffness and hysteresis of each sample.

RESULTS. The DRL originates from the dorsoradial tubercle of the trapezium and inserts onto the dorsal edge of the base of the first metacarpal. The length of the DRL obtained via MRI amounted on average to 9.98 ± 1.05 mm versus 13.34 ± 1.77 mm obtained during dissection. The average thickness of the DRL was 1.11 ± 0.16 mm and average width 12.09 ± 1.61 mm. The AOL originates from the volar tubercle of the trapezium and inserts across the volar ulnar tubercle of the first metacarpal. The length of the AOL measured via MRI gave an average length of 12.16 mm ± 2.14 mm, while the length obtained during dissection amounted on average to 13.46 ± 2.77 mm. The average thickness of the AOL was 0.64 mm ± 0.13 mm and average width 13. 60 ± 2.62 mm. Anatomical data demonstrated a statistical significant shorter length of the DRL obtained via MRI versus dissection ($V = 0$, $p < 0.005$). Both methods did not result in a significantly different length measurement for the AOL ($V = 37$, $p = 0.1$). Force-elongation curves of each DRL and AOL sample were obtained. The average stiffness of the DRL was 89.00 ± 21.02 N/mm, and that of the AOL amounted to 65.07 ± 29.57 N/mm. The hysteresis of the DRL amounted on average to 24.67 ± 2.72% and 21.31 ± 3.57% for the AOL. Statistical analysis of the data demonstrated the DRL to be significantly stiffer than the AOL ($V = 78$, $p < 0.05$), with a significantly higher hysteresis ($V = 66$, $p < 0.05$).

DISCUSSION. Our results show that the DRL is significantly shorter and thicker than the AOL, which is thin and ill-defined. Our results also indicate that the DRL has a higher stiffness than the AOL, making it a more likely candidate to provide joint stability. These results suggest that the DRL can play an at least equal role to the AOL in stabilizing the TMCJ since it has the mechanical potential to withstand higher loads than the AOL. Hence the concept of the AOL as prime stabilizer of the TMCJ should be reconsidered.

COI. No conflicts of interests.