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Opinion Article

Studies to Elucidate Stabilization and Anatomical Mechanisms

Young Horsnell*

Department of Hematology and Oncology, Queen Elizabeth Hospital, Adelaide, Australia

DESCRIPTION

To determine the etiology of mitral-metacarpal joint instability leading to osteoarthritis, the surrounding ligaments, muscles (First Dorsal Interosseous (FDI) and contralateral thumb (OPP)), and the anatomical relationship between the joint capsule. Bone morphology and cortical bone thickening of 25 cadaver thumbs were examined using micro-computed tomography and macroscopic and histological analyses. The dorsal trapezoid had a nodule with cortical bony thickening corresponding to the insertion of the FDI aponeurosis mixed with the joint capsule. Radially, a thin joint capsule was beneath the muscle portion of the OPP. Thus, the dorsal ligament, previously thought to be a static stabilizer, can be interpreted as part of the FDI aponeurosis and joint capsule aponeurosis complex. In the radial plane, muscle OPP activation may be essential for TMC joint stabilization. Our results may contribute to the appropriate management of TMC osteoarthritis.

The Trapezoidal Meta Carpal (TMC) joint is a biconvex saddle joint consisting of the 1st metacarpal (1st MC) and a trapezoid. Allows great freedom of thumb and multi-directional movement. Joint instability due to overuse or injury causes TMC osteoarthritis, causing pain, joint dysfunction, and dorsal radial subluxation of the 1st MC. TMC joint stabilization has been elucidated by two mechanisms:

Static (with surrounding ligaments) and dynamic (with adjacent muscles). The first leads to dorsal radial subluxation of the MC. Identification of a clear anatomical relationship between static and dynamic stabilizing structures, especially in the dorsoradial portion of the TMC joint, may clarify the actual etiology of TMC joint instability.

The dorsal and Anterior Oblique Ligaments (AOL) have been described as important static stabilizers during a pinch. However, it has been described that the 'ligament' is histologically indistinguishable from the surrounding aponeurosis and joint capsule.

Anatomical studies have recently reported that in joints such as elbows, hips and knees, 'ligaments' are interpreted as part of the periarticular aponeurosis thought to contribute to dynamic stabilization.. Although the ligaments of the TMC joint are adjacent to the surrounding muscles, the laminar relationship between the ligaments and surrounding elements such as muscle, aponeurosis, and joint capsule is rarely discussed.

We proposed that the ligaments of the TMC joint are part of the first dorsal interosseous ligament (FDI), the contralateral thumb (OPP), and the periarticular aponeurosis of the joint capsule. In particular, we hypothesized that joint capsules fused with cortical bone and aponeurosis under tensile stress are thicker than other sites. The aim of this study was an anatomical analysis of the TMC joint based on the surrounding muscles and joint capsule rather than specific ligaments. This may help elucidate the mechanisms underlying dynamic stability of TMC joints based on anatomical findings and contains clues for improving management of TMC osteoarthritis.

This study has some limitations. First, it was purely anatomical. The dynamic contribution of surrounding musculature to TMC joint instability was not assessed. Therefore, prospective studies with additional imaging evaluations and clinical cases are needed to validate our results. Second, this study was limited to Japanese specimens. The site of supernumerary tendon insertion varies by ethnic group. Third, the method for measuring cortical bone and TMC joint capsule thickness was cumbersome. Therefore, your results may vary. To validate these methods, we assessed the Infraclass Correlation Coefficient (ICC). The ICC scores in our study were 0.85 and 0.995, so we consider these methods reproducible.

Correspondence to: Young Horsnell, Department of Hematology and Oncology, Queen Elizabeth Hospital, Adelaide, Australia, E-mail: horsnell@uhrc.au

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