The trapeziometacarpal ligaments: importance of their anatomy in choosing a surgical approach

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Introduction

TMC J
fantasmatic joint since ever!

- saddle joint
- up to 16 described ligaments
- various nomenclature, ligament identification
- x anatomical and biomechanical studies

Bettinger 1999
Introduction

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DRL/AOL important stabilizers of the TMC J ?
Controversy in literature

Pro AOL
Eaton et al. 1973,
Pellegrini et al. 1991,
Imaeda et al. 1992,
Najima et al. 1997...

VS

Pro DRL
Bettinger et al. 1999, 2000,
Comtet et al. 2006,
Nanno et al. 2006,
Colman et al. 2007...
Introduction

Surgical approaches

Anterior versus Posterior (dorsal or lateral)
Complications linked described in lit.

Choice ?
Largely subjective
Based on surgeon’s education, experience and preference
Early descriptions and concepts of stabilizing structures (Eaton)

Structures transected completely ≠
May have an important impact on functional outcomes
Major importance regarding main goals of procedures
Introduction

Research objectives

Detailed anatomical data (dissection-imaging-biomechanics)
Main stabilizing ligaments of the TMC J ?

Clinical relevance
Surgical approach ?
Structures to be reconstructed ?
New concepts ?
Materials & Methods

Sample

13 unfixed hands
9 human specimens < KU Leuven human body donation programme
Mean age 74y
Eaton stage > II excluded
Prior dissection High-definition MRI → Ligs length and thickness (n=9)
(PDspair, PDW-aTSE, T2W-aTSE and 3D 0.45 ISO)

Eaton IV

Thumb MRI

dimanche 24 mars 2013
Materials & Methods

Step-by-step dissection

One fully trained hand surgeon
x4.5 loupe magnification
DRL and AOL isolation
Blunt-tip probe
Digital Caliper 0.01

→ Ligs length and width (n=13)
Materials & Methods

Step-by-step dissection
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Material testing

Harvesting «en bloc» (n=13)
Materials & Methods

Material testing

Thumbs sagittally cut < Piezotome
26 bone-ligament-bone complexes (13 AOL, 13 DRL)
Materials & Methods

Material testing

Samples preparation for mounting in material testing device (Bose)
Cyclic, distance-controlled tensile tests (2Hz; 40 cycles; pre-conditioning at 0.5N)
Until maximal loading of 150 N or ligament/bone rupture
Elongat°(mm) - force (N) recording and Siffness - Hysteresis calculation
Results

Descriptive anatomy of DRL and AOL

Dorsoradial Ligament (DRL)

Runs from Trap dorsoradial tubercule to dorsal edge MC1 base
Radial side : APL tendon
Ulnar side : Posterior Oblique Ligament (POL)
Triangular shape, well-defined
Results

Descriptive anatomy of DRL and AOL

Anterolateral Ligament (AOL)

Just beneath the thenar muscles
Runs from Trap volar tubercule to palmar beak of MC1
Very thin, capsular-like, ill-defined
Results

Dimensions of DRL and AOL

DRL significantly shorter, thicker and more narrow than AOL
Results

Dimensions of DRL and AOL

DRL significantly shorter, thicker and more narrow than AOL
Results

Material properties of DRL and AOL

DRL significantly stiffer than AOL (p 0.02)
DRL hysteresis significantly higher than AOL (p 0.03)

average $S = 89$ N/mm ($\pm 21$ N/mm)
average $H = 25\%$ ($\pm 3\%$)

average $S = 65$ N/mm ($\pm 30$ N/mm)
average $H = 21\%$ ($\pm 4\%$)
Conclusions

DRL is thicker and stiffer than AOL ➔ more likely to act as stabilizing structure

Joint capsule and surrounding musculature provide additional stabilization

Clinical relevance: spare or reconstruct DRL in TMC J surgery ➔ thumb full functionality