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Biomechanical investigation of flexor digitorum tendons in trigger finger patients using sonography

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Introduction:

Trigger finger (TF) has generally been ascribed to primary changes in the first annular (A1) pulley. Repeated friction between the A1 pulley and flexor digitorum tendons could result in swelling of soft tissues, and thus it has been speculated that TF affects tendons' biomechanical behaviors. However, the pathology mechanism related to these behaviors remains unclear. The purposes of this study are to understand (1) the variations in the morphologies of the flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) between normal fingers and TFs, (2) the differences in the biomechanical behaviors of the FDP and FDS between normal fingers and TFs in various finger flexion positions, and (3) the effect of various finger positions on the biomechanical behaviors of the FDP and FDS.

Methods:

The human protocol was approved by the Institutional Review Board of National Cheng Kung University Hospital. All participants clearly understood the purpose of the study and signed consent forms. In this study, a sonographic technique and custom-designed isokinetic dynamometer were used to measure tendon forces and displacements of the flexor digitorum tendons at different flexion angles in the distal (DIP) and proximal (PIP) interphalangeal joints. The measurements of the tendon forces and displacements were used to calculate the biomechanical behaviors of the FDP and FDS. This study recruited 14 healthy controls and 11 TF patients.

Results:

The results demonstrate that both the FDP and FDS of TF patients were significantly ($p < 0.05$) thicker and stiffer at 60° for the DIP and 30° for the PIP, than those of the

controls. In the healthy participants, FDP stiffness, FDP tendon force, and FDS tendon force significantly ($p < 0.05$) decreased when the joint angle was increased.

Discussion/Conclusion:

This study provides more information on the biomechanical behaviors of the flexor digitorum tendons and contributes to the understanding of the relationship between tendon force and displacement at different DIP and PIP flexion angles. The results show that TF flexor digitorum tendons have greater thickness, which may inhibit flexibility and impede the tendons' movement through the A1 pulley during finger flexion and extension. In addition, TF patients had higher FDP and FDS stiffness than the controls. These findings may contribute valuable information to what is known about the biomechanical behavior of the flexor digitorum tendons in TF. Such knowledge could help clinicians provide optimal rehabilitation programs and interventions for TF patients.

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