Intrinsic Reconstruction in a Tetraplegic Grip/Extension Model—The Challenge of Extrapolating From the Cadaver to the Patient

There is inadequate evidence-based practice in tetraplegic hand reconstruction because of limited subject numbers and heterogeneity between patients. These limitations increase the potential value of models to better understand the functioning of the tetraplegic hand. The cadaveric model illustrated in the article under discussion[1] provides information regarding the impact of intrinsic loading or absence on simulated grip functioning and the impact of two different reconstructions to reduce the deformity observed in intrinsic minus hands.

Although the described model provides valuable information regarding the potential impact of "intrinsic reconstruction" in the tetraplegic patient population, the limitation of the model precludes direct comparison to the clinical situation. One critical limitation is the lack of wrist motion in the model. Tenodesis provides rudimentary grip for most mid-level tetraplegic patients and is an essential component in the functioning of the static Zancolli-lasso procedure for these patients. The authors have attempted to address this consideration by using a 40° fixed metacarpophalangeal (MCP) joint position to mimic the position of the MCP joint when the wrist is in functional position. This may be a reasonable compromise given the limitations of the model, but it fails to reflect the potential MCP motion experienced by patients with tetraplegia using wrist motion related—tenodesis.

A more important consideration is the method the authors used to determine the force and excursion for their model. The authors thoughtfully selected experimental variables to maximize the value of the data from this model. Specifically, the values selected were based on what works for the model, not what is available clinically. Unfortunately, it is unclear if these findings can be reasonably generalized to reflect the anticipated clinical results of patients with tetraplegia. For example, the choice of 50 mm of flexor digitorum profundus excursion is based on the finding that this resulted in complete finger flexion. This is greater than the published excursion for extensor carpi radialis longus (typical motor used in mid-level tetraplegic patients to achieve finger flexion). It is possible that the combination of extensor carpi radialis longus excursion (~30 mm) in combination with wrist tenodesis achieves a similar range, but the reported outcomes for the cadaveric model may overestimate the potential outcome of this transfer in a patient with tetraplegia. Given the specific limitations in these patients (limited available "motors", pre-existing joint contractures, potential spasticity), it is not possible to optimize outcomes by altering the excursion or force of the transferred tendons. The inability to optimize these values clinically may explain the observed equivalence of these passive tenodesis procedures previously documented by House and colleagues.[2]

Taken as a whole, this study should be regarded as an important cadaveric model to direct future clinical studies, not a road map for clinical practice.

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REFERENCES

1. Muzykewicz DA, Arnet U, Fridén J, Lieber RL. The effect of intrinsic loading and reconstruction upon grip capacity and finger extension kinematics. *J Hand Surg Am*. 2015;40(1):96–101.
2. McCarthy CK, House JH, Heest AV, Kawiecki JA, Dahl A, Hanson D. Intrinsic balancing in reconstruction of the tetraplegic hand. *J Hand Surg Am*. 1997;22(4):596–604.

