Measuring Joint Flexibility in Hallux Rigidus Using a Novel First Metatarsophalangeal Joint Flexibility Jig

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Introduction/Purpose: Range of motion measurements of the first metatarsophalangeal joint (MTPJ) are an essential component in assessing and classifying hallux rigidus (HR). However, they provide little information about joint function and are limited by variability in technique. As an alternative, measuring joint flexibility can characterize intrinsic properties of the joint—aside from simply maximum dorsiflexion and plantarflexion—that may prove more clinically meaningful. No prior study has assessed hallux MTPJ flexibility in patients with HR. The purpose of this study was therefore to assess the reliability of a custom flexibility device and to compare flexibility between HR patients and controls.

Methods: Fifteen patients with Coughlin stage II or III HR indicated for cheilectomy and 20 healthy controls were recruited prospectively. Each of two raters performed a series of seated and standing tests on each subject with the device. Dorsiflexion angle and applied torque were plotted against each other to generate a flexibility curve. “Early flexibility” and “late flexibility” were defined as the slope of the curve in the first 25% and last 25% of motion, respectively. From these two parameters, three additional parameters were calculated: laxity angle, laxity torque, and torque angle (Figure). Differences between (1) HR patients and controls and (2) sitting and standing testing positions were assessed with t-tests. Intra-rater test-retest reliability, remove-replace reliability, and inter-rater reliability were assessed with intraclass correlation coefficients (ICCs).

Results: Patients in the HR group were older than patients in the control group (p < 0.001) and had significantly lower maximum dorsiflexion (p < 0.001). HR patients were less flexible as measured by three of the five flexibility parameters: early flexibility (p = 0.027), laxity angle (p < 0.001), and torque angle (p = 0.002). After controlling for age on seated measurements, only laxity angle and maximum dorsiflexion differed significantly between HR patients and controls (p < 0.001). Generally, patients were more flexible in the seated position than in the standing position, with this effect being more marked in HR patients. All parameters had good or excellent intra- and inter-rater reliability (ICC = 0.60).

Conclusion: This is the first study to demonstrate a reliable method of measuring first MTPJ flexibility in patients with HR. We found that flexibility, even early in the arc of motion, is impaired in patients with HR. Moreover, significant differences between sitting and standing measurements suggest that soft tissue tension may be a major contributor to this finding. We do not know yet how flexibility of the joint relates to symptomatology, or if the surgeries performed for HR affect flexibility. Further research will be required to determine the clinical utility of these measurements.

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