



The Effect of Different Thumb Orthoses on Thumb Stabilization and Hand Function in Individuals with Carpometacarpal Osteoarthritis

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INTRODUCTION

The mainstay of conservative care of thumb carpometacarpal (CMC) osteoarthritis (OA) is immobilization by splinting [1]. Orthotic designs have to reconcile and satisfy the competing goals of providing stability and mobility. Both are obligate for patient compliance and therefore treatment success. Thumb kinematics describing the stabilization effectiveness of thumb orthoses combined with evaluations of hand functionality are mandatory for successful splint designing, but have not been reported yet. Thus, the purpose of the study was to characterize the stabilization effectiveness and functionality of different thumb CMC OA orthoses.

MATERIALS AND METHODS

Eighteen female subjects diagnosed thumb CMC OA were included. Four different thumb orthoses were compared: Rhizo Forte V/2013, BSN medical (BSN); Ortho CMC, Push braces (PUSH); Rhizo Hit, Sporlastic (SPOR); Rhizomed, medi (MEDI). A 6 infrared camera system at 100 Hz (VICON Motion Systems, Oxford, UK) was employed to quantify 3D thumb kinematics during maximum active opposition-reposition without and while using the orthoses. Retro-reflective marker arrays consisting of three retro-reflective markers were attached to the skin of thumb Os metacarpale (Metacarpale I) and Phalanx proximalis as well as on Os metacarpale (Metacarpale II) of the index finger (Fig. 1A). Ranges of motion (ROM) of the thumb CMC joint were determined while hands were fixed in a custom made test bench (Fig. 1B). Hand functionality was examined by Sollerman test scoring 20 activities of daily living (maximum score of 80).

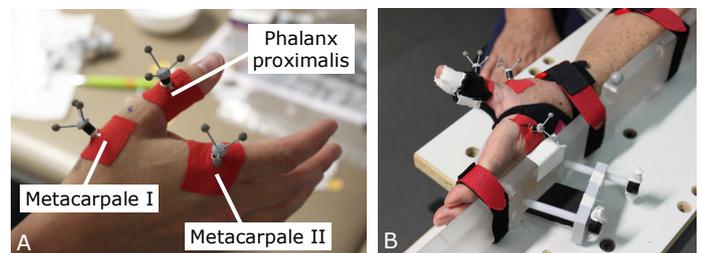


Fig. 1. (A) Marker arrays positioned on thumb and index finger. (B) Hand fixed and positioned in custom made test bench during maximum active opposition-reposition.

RESULTS

Without orthosis ROM of CMC joint was 44.2° in flexion-extension, 25.8° in abduction-adduction and 37.3° in pronation-supination (Fig. 2). All orthoses significantly restricted ROM in flexion-extension (39-64%), adduction-abduction (37-68%) and pronation-supination (29-61%). Mean flexion-extension ROM was significantly smallest with MEDI and BSN compared to PUSH and SPOR. Mean adduction-abduction ROM was significantly largest with PUSH compared to all other orthoses. Mean pronation-supination ROM was significantly smaller with BSN and MEDI compared to PUSH, but similar to SPOR. Mean Sollerman sum score was highest with PUSH (78), lowest with MEDI (46) and both differed significantly from the other orthoses (Fig. 3). Mean sum scores with BSN (72) and SPOR (75) were between the values of PUSH and MEDI and showed no statistical difference.

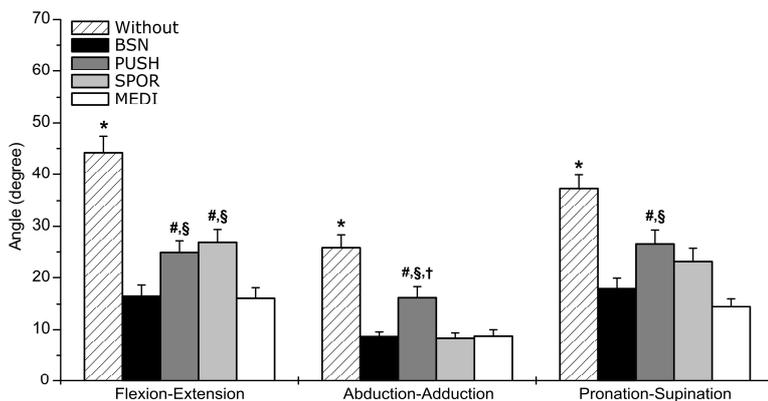


Fig. 2. Ranges of motion of the thumb CMC joint during opposition-reposition with and without orthosis. Mean \pm SE. *significantly different from all orthoses $p < 0.05$, #significantly different from BSN $p < 0.05$, \$significantly different from MEDI $p < 0.05$, †significantly different from SPOR $p < 0.05$.

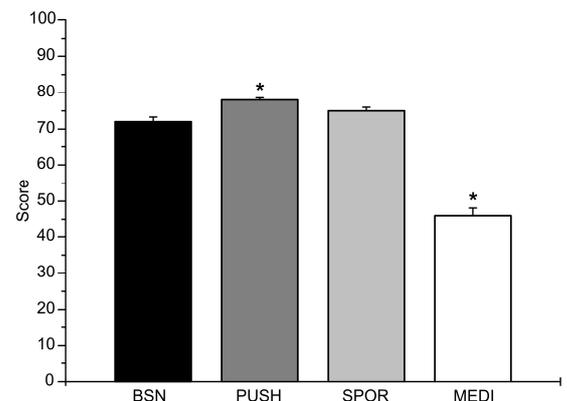


Fig. 3. Mean Sollerman sum score of hand function while using the orthoses. Mean \pm SE. *significantly different from all other orthoses $p < 0.05$.

CONCLUSION

Stabilization seems to be at the expense of functionality. MEDI afforded best stabilization at lowest functionality, while PUSH provided best functionality at lowest stabilization. Best compromise of stability and functionality could be reached with BSN. Long-term studies are needed in order to monitor patient compliance and if pain relief can be archived by the orthoses.

REFERENCES

[1] Barron OA, Glickel SZ, Eaton RG (2000) Basal joint arthritis of the thumb. J Am Acad Orthop Surg 2000 8(5): 314-23