RELIABILITY & VALIDITY OF A NOVEL OVERHEAD LOAD CARRIAGE & POSTURAL INTEGRITY SCREEN FOR TACTICAL PERSONNEL

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Rationale and Experimental Design

BACKGROUND:

- Tactical personnel are commonly dismissed from training programs due to shoulder injuries exacerbated by limited torso and shoulder complex stability and control.[1]
- Tactical training upper limb injuries likely occur due to high load application on the shoulder complex in the overhead position without proper stability, integrity, and function with the thoracic spine.[2]
- The U.S. Army and Navy special forces recently modified their physical testing to involve additional tests of force application and load management.
  - New protocols largely neglect the overhead position and stability of the shoulder complex.
- The Fundamental Capacity Loaded Carry Screen and the Overhead Press Strength Test both separately assess load bearing capacity and shoulder complex stability BUT lack examination of the shoulder complex-thorax relationship during movement when carrying load overhead.
- Large gap in the research literature regarding the role that the glenohumeral and scapular complex play with the thorax and spine to examine aptitude for overhead load carriage training, durability, and longevity.

PURPOSE:

- Determine the reliability and validity of a novel overhead carry screen to comprehensively assess overhead load carrying capacity and postural integrity.

RECRUITMENT:

- Inclusion criteria: age (18-45yrs), training age (>2yrs RT experience), shoulder complex health & core/torso control (FMS & MCS passing scores).

OVERALL DESIGN:

- 17 resistance-trained (RT) individuals (11-male, 6-female) with substantial overhead pressing experience completed 4-d of testing across 3-4-wks.

FIGURE 1. Mastering Marine log drills demonstrating overhead log carriage. Photo Credit: Marine Boot Camp HQ

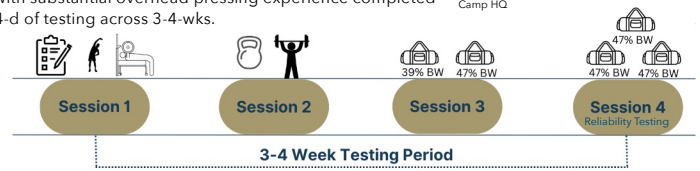

FIGURE 2. Observational study design. Testing time points are shown with overall duration of the study. %BW represents the sandbag load implemented during the session.

Conclusions and Application

- Strong test-retest reliability
- High face validity
- More robust criterion validity (47% BW load) for strength, function, & control vs. established field-based strength tests in the tactical community
- Carriage time and load may be more reliable OCS outcomes vs. carriage distance

Use OCS as pre-training screening tool to:

- Identify shoulder girdle, thorax, & spine movement & neuromuscular dysfunction BEFORE ↑↑ activity density
- ↑↑ tactical operator safety & durability

Future research modifications:

- Use strength outcomes as inclusion criteria to solidify validity

Results

- Common upper body strength test results → 2 feasible OCS relative loads: 39% BW (relative OHP 10-RM load) & 47% BW (OHP/BP 10-RM load ratio).
- OHP 10-RM load lifted → large correlation with carriage distance (cDIST) outcome of both OCS loads (39% BW: r=0.40, 47% BW: r=0.41).
- OCS and FCS outcomes → poorly correlated (r<0.10).

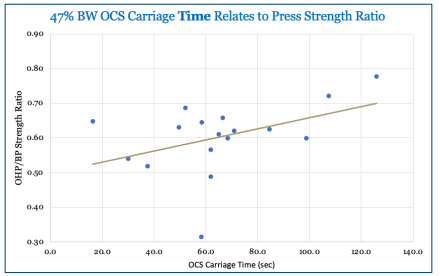

Figure 7. OCS carriage time (sec) at 47% BW load demonstrated large correlation with 10-RM overhead press-to-bench press load ratio (r=0.51).

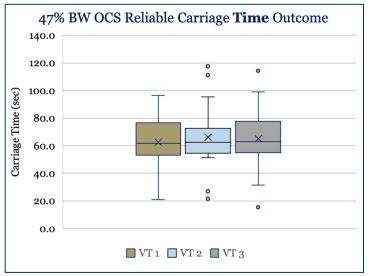

Figure 10. OCS carriage time (sec) outcome at 47% BW load demonstrated good test-retest reliability (0.90, CI: 0.80-0.96) across three volitional trials (VT) via ICC assessment.

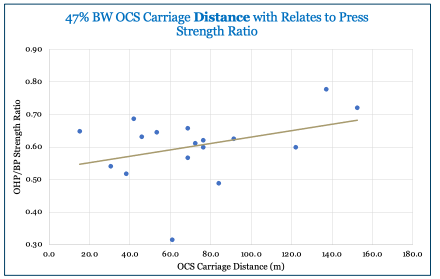

Figure 8. OCS carriage distance (m) at 47% BW load demonstrated large correlation with 10-RM overhead press-to-bench press load ratio (r=0.40).

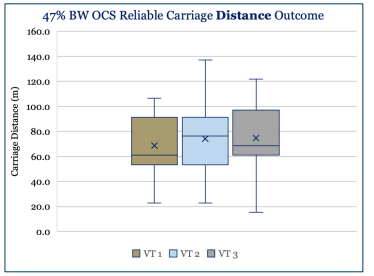

Figure 11. OCS carriage distance (m) outcome at 47% BW load demonstrated good test-retest reliability (0.79, CI: 0.56-0.93) across three volitional trials (VT) via ICC assessment.

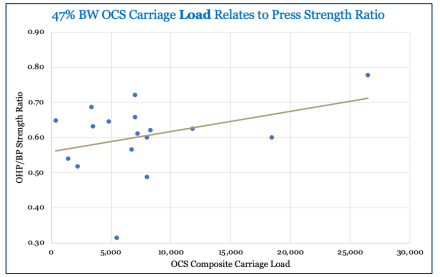

Figure 9. OCS composite carriage load at 47% BW load demonstrated large correlation with 10-RM overhead press-to-bench press load ratio (r=0.39).

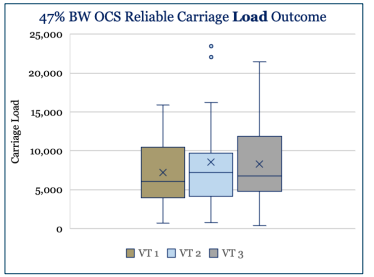

Figure 12. OCS composite carriage load outcome at 47% BW load demonstrated good test-retest reliability (0.87, CI: 0.74-0.95) across three volitional trials (VT) via ICC assessment.

Methods and Procedures

DATA COLLECTION:

- [inclusion criteria] **Functional Movement Screen** (FMS) and **Motor Control Screen** (MCS, FMS, Chatham, VA, USA):
  - Glenohumeral, scapulothoracic, and torso symmetry and function via passing score for upper quarter screens
- **Bench Press** (BP) **and Overhead Press** (OHP) **Strength Testing**:
  - 10-repetition maximum (10-RM) multi-set protocols to determine upper body strength
- **Fundamental Capacity Loaded Carry Screen** (FCS, FMS, Chatham, VA, USA):
  - One max. effort suitcase-carry with 75% BW load (37.5% BW / limb)
  - Composite Carry Load (CC_{load}) = ($Carry_{wt}$ × $Carry_{dist}$ × $Carry_{time}$) / BW
- **Overhead Carry Screen** (OCS novel protocol)
  - Relative load ratios from BP and OHP testing used to determine OCS loads of 39% and 47% BW
  - Multiple OCS trials with one sandbag held in full flexion longitudinally overhead (10-min recovery)

STATISTICAL ANALYSIS:

- Pearson correlation was used to analyze criterion validity of both OCS load variations with common BP, OHP, and FCS outcomes.
- Intraclass correlation coefficient (ICC) was used to analyze OCS test-retest reliability, across three trials in session 4.

Figure 3. 10-RM Overhead Press Test

Figure 4. Fundamental Capacity Carry Screen

Figure 5. Overhead Carry Screen

Figure 6. 10-RM Bench Press Test

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