INTRAMUSCULAR PRESSURE: A BETTER TOOL THAN EMG TO OPTIMIZE EXERCISE FOR LONG-DURATION SPACE FLIGHT.
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INTRODUCTION. A serious problem experienced by astronauts during long-duration space flights is muscle loss. In order to develop countermeasures for this problem, a simple method for monitoring in vivo function of specific muscles is needed. Previous studies document that both intramuscular pressure (IMP) and electromyography (EMG) provide invaluable monitoring of muscle contractile activity. However, at present there are no data available concerning the usefulness of IMP versus EMG for monitoring muscle function. METHODS. IMP (Hypross catheter) and surface EMG activity (Caddock, Inc.) were measured continuously on the anterior (TA) and soleus (SOL) muscles of 9 normal male volunteers (25-54 years). Two parameters were recorded during both concentric and eccentric exercises which consisted of plantarflexion and dorsiflexion of the ankle joint. A Lido Active Isokinetic Dynamometer concurrently recorded ankle joint torque and position. RESULTS. Intramuscular pressure correlated linearly with contraction force for both SOL (r=0.837) and TA (r=0.948) during concentric exercise. SOL and TA EMG did not correlate as well with force during concentric exercise (r=0.476 and r=0.426, respectively). During eccentric exercise, SOL and TA IMP also correlated linearly with contraction force (r=0.756 and r=0.702, respectively), but SOL and TA EMG correlated poorly with force (r=0.439 and r=0.702, respectively). CONCLUSIONS. IMP measurement provides a better index of muscle contraction force than EMG during concentric and eccentric exercise. IMP reflects the functional properties of individual muscles, such as length-tension relationships. Although invasive, IMP provides a more powerful tool than EMG for developing exercise hardware and protocols for astronauts exposed to long-duration flight. (Supported by NASA)
COMPARISON OF UPPER BODY STRENGTH IN A STANDARD EVA FOOT RESTRAINT WITH A RIGID EVA ENCLOSURE IN A NEUTRAL BIODYANIC SETTING. M. Barragán, Department of Aerospace Medicine, Wright State University, Dayton, OH 45403

INTRODUCTION. A rigid EVA enclosure with full length anthropomorphic arms and mechanical restraint system offers several theoretical advantages over current EVA systems. To assess human factors aspects of such an enclosure, a mockup was constructed for neutral buoyancy testing. Upper body strength, an important contributor to performance, was measured in subjects in the mockup and compared to that in a simulated EVA foot restraint. METHODS. Using an underwater load cell in a standardized position for force measurement, exertion profiles consisting of 16 separate configurations were assessed by 11 male subjects. Variables examined were environment (enclosure vs. foot restraint), restraint with the opposite hand (yes or no), direction of exertion (forward vs. backward), and use of opposite hand use (yes or no). RESULTS. ANOVA revealed a global enhancement of strength for exertions performed in the enclosure (p<.001). Use of the opposite hand for restraint enhanced strength (p<.001). Subjects moved closer physically. It may be hindered by factors related to sharing a unique similar life experience or being in an environment may influence crew member interactions. METHODS. Fifty-four American, European, and Soviet astronauts and cosmonauts who had flown in space were assessed. Subjects were noted for the presence or absence of right and left exertions (p<.001). Hand used for a given exertion did not influence strength. Significant first order interactions (p<.005) were noted between environment and direction, environment and opposite hand use, and direction and opposite hand use. CONCLUSION. A rigid enclosure offers a strength advantage over a standard EVA foot restraint. Overall strength in the enclosure without opposite hand use was greater than overall strength in the foot restraint with opposite hand use. Thus, the enclosure allows a greater force exertion while sparing the opposite hand from fatigue induced by grasping.

VAPOPRESSIN DOES NOT INCREASE SUSCEPTIBILITY TO CORIOLIS STRESS. G. Hodder, R. Shepard, T. Nagler, Y. Wang, S. Parper and W. Lockette, Wayne State University School of Medicine, Detroit; VAMC, Allen Park; and University of Michigan Medical School, Ann Arbor. We demonstrated that intranasal administration of 5-desamino-8-D-arginine vasopressin (DAPAV) can counter the negative effects of Coriolis forces on human subjects. DAPAV can cause increases in plasma volume that can follow operational maneuvers at sea or during exposure to microgravity. However, since provocative motion increases plasma volume, DAPAV may not be an effective countermeasure to motion sickness. We tested this hypothesis--the increase in [AVP] during motion sickness may be due to a decrease in plasma volume. However, our data show no discernible effect on the number of head movements subjects could complete while being rotated at increasing velocity before they developed motion sickness. In the present study, 10 male volunteers completed a double-blind crossover trial where they were administered placebo or DAPAV and were then exposed to rotation at increasing angular velocity. Results. Subjects. Results. Subjects. Results. Conclusion. No significant difference was noted between the placebo and DAPAV conditions. However, our data show that DAPAV may not be an effective countermeasure to motion sickness. Further study is needed to determine the effectiveness of DAPAV as a countermeasure to motion sickness.


INTRODUCTION. Lyczek proposed that motion sickness develops in man and animals when rhythmic changes in body displacement centering around 12/sec synchronize brain waves occurring in the medial temporal lobe range (10.17-0.25 Hz for zeta rhythms). The resonance hypothesis is based on some selected factors associated with MS but is inconsistent with other evidence. METHODS. Squirrel monkeys, cynomolgus monkeys and cats were exposed to continuous linear vertical and horizontal displacement on a circular motion simulator. RESULTS. Motion sickness was noted in some subjects. Conclusion. A different phenotype was highly resistant to all motion. Neither vertical displacement nor horizontal rotation created signs of MS in cynomolgus monkeys or cats. Based on data from CTZ-ablated animals, the postulated link between zeta rhythm, poisoning and MS is questionable.

CONCLUSIONS. The resonance hypothesis of MS and the postulated link between zeta rhythm, poisoning and MS is questionable.