

M.S.

Presentation

Background and problem

Verbal

Theory

Strength

Coordination

Cardiovascular Cond-

Myocardium

Vessels

Results of Space Flight

3 exps -

1 - inadequate exercise

2 - C.V. & Arm exercise

3 - " & " " & Treadmill

Bicycle

Inadequate load - muscular atrophy
legs, back

N

Measure external work

Good Cardiovascular Conditioner

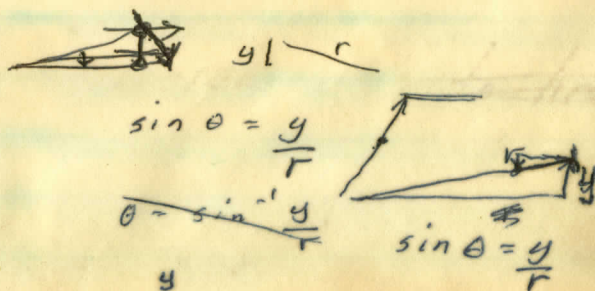
Treadmill

Good back, leg -
Neurological

Measure External Work

Best Card. Vasc. Cond-

~~Stays~~



Exer

1. To maintain strength and ~~muscle~~ mass, a muscle must be exercised at a force level ~~to~~ which it is accustomed -
 - In one g, legs are subjected to hundreds of pounds for thousands of times per day
 - To gain strength muscles must work against greater than normal forces
 - For endurance, muscles must work for long periods of time and against ~~tower~~ ^{less than maximum} forces -
 - Muscle in good condition has increased tone
2. Prolonged Use of larger muscles require increased ~~food~~ ~~blood flow~~ - oxygen and fuel
 - Heart must pump up to ~~times~~ ^{times} the normal amount of blood
 - Heart enlarges with prolonged exercise
 - ~~Blood Volume~~ ^{oxygen from}
 - Muscles extract more ~~blood~~
3. Blood return to heart ^{must be} ~~is~~ increased ~~to heart~~ in exercise
 - heart can only pump ~~at what~~ amount that is received

Exer

Treadmill

- ~~##~~ Allows walking - running under 1 G equiv. loads
- ~~No power required~~ prolonged aerobic ex-
- No power required
- $\sim 30^\#$ wt.
- can give precise work measurement for Experimental work -
- slows for launch reentry

Bicycle

inadequate

- forces are $\sim 1/3 - 1/4$ those in walking)
- does not "load back"
- ~~does not~~ exercises a limited number of muscles quite different from those used in walking
- allows precise external work measurement for Experimental work

Exer

4

: blood may pool in legs through decreased tone and pumping action

: blood volume is decreased

∴ crewman has little orthostatic defence

Prevention

- Legs and back must have heavy loading - equivalent ~~on the order of~~ body weight -
- ~~Desirable for this to be maintained~~
Desirable to maintain have ~~marked~~ a high oxygen uptake
- Most rational exercise is walking/jogging
 - ~~maintains leg b~~ under 1G loads
 - High ~~leg~~ leg
 - ∴ heavy leg back loads
 - ∴ high oxygen uptake
 - ∴ exercises neuro-muscular ~~system~~ system

Exer

3

- Muscle pump of legs aids heart in circulation
- Red cell mass and plasma volume is increased

4. Human Body in Space

- Forces on muscle are greatly reduced especially legs & back
- Legs are virtually unused in flight & rapidly lose strength and mass
- Arms
- Blood Volume is reduced
- On Very Long Flights Heart Muscle Could Weaken

5. Effects of On Return to Earth

- ~~Muscles mass are weak~~
- Arm muscles may be reduced
- ~~On longer flights~~ loss of leg muscle may be crucial
- strength & coordination may be inadequate for locomotion -