



*CONCENTRIC / ECCENTRIC
CONTRACTIONS*

EMG

by

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EARLY STUDIES

- *Energy cost : positive x negat. work.*
- *Chauveau, 1896: O2 consumption of man walking downstairs less than upstairs*
- *Asmussen, 1953: negative work at 1/3 to 1/9 the cost of positive work - bicycle ergometer.*
- *Comparison of concentric/eccentric training: mixed results.*

Concentric & Eccentric muscle training.....

- *Johnson et.al., 1976: unilateral training of arms and legs (con. x ecc.). Six wks / 3x/2 sets of 10 reps. 80% of 1 RM for conc.and 120% for ecc. No difference in strength gains.*
- *Hortobagyi & Katch, 1990: combo of conc / ecce , free weightX conc. training, hydraulic resist. (bench press, squats). 3 x wk / 12 wks / 5 sets /1-6 RM. No diff. in strength gains.*

Advantages of Eccentric Muscle Training

- *Colliander & Tesh, 1990: Con X ConEcc group, 5 sets ,12 reps, 3 x wk, 12 wks. Quads. Increase in peak torque, strength related performance parameters in ConEcc. Neural Adapt.*
- *Hather et.al., 1991: con/con; con/ecc; Con groups. Leg press & leg ext., 6-12 reps, 4-5 sets, 2xwk, 19 weeks.*
- *biopsy: VL/ con/ecc: fiber hyper .25% / 20% con/con,*
- *Dtng: Con/Ecc fiber hypertrophy.*

Eccentric muscle training.....

- *Dudley, et.al., 1991:ConEcc > Concon > Con. for increases in strength measured as RM. 4-5 sets, 6-12 reps, 19 wks, leg ext & leg press, 2x wk.*
- *Omission of eccen.*
- *action from resistance trng compromises increases in streng.*
- *Neural adapt. increa. in central activation,synchronizati on of MU and or decrea. the input from neural inhib. reflexes.*

Eccentric Trng & Velocity

- *Lacerte, et.al., 1992:conc.slow;con fast; ecc slow; ecc fast.*
- *20 reps/quads/5 x wk for 12 wks.*
- *60 or 180 degrees per second*
- *Peak torque gains greater in ecc. groups regardless of velocity.*

EMG STUDIES.....

- *Tesh et.al., 1990: Fatigue responses between con & ecc quads muscle action (32 unilateral MVC X 3 sets).*
- *torque was greater for Ecc than Con throughout exercise.*
- *EMG activity greater for Con than Ecc at the beginning and during exercise.*
- *IEMg torque ratio greater for Con but decreased by the end of 3rd set.*
- *Ability to maintain force during MVC greater for ECC.*

TESH et.al., 1990.....cont.....

- *Different fatigue responses to repeated bouts of con and Ecc muscle action.*
- *Decrease in force during Con exerc. was not paralleled by a corresponding decrease in neural drive.*
- *During ECc exerc. neither force or IEMG changed during exercise.*
- *Mean power freq. decreased for con and no change in Ecc. Changes in MU recruit. or muscle fiber conduct. for con.*

EMG studies cont.....

- *Hortobagyi et.al., 1996: Con x Ecc quads unilateral. 36 sessions / 12 wks.*
- *Ecc. trng increased ecc. strength 46% over 13% with Con.*
- *EMG activ. higher during testing for*
- *Ecc. (86%) than Con. testing (12%).*
- *Type II fibers increased about 10 times more in ECC than Con.*
- *Greater neural adapt. and muscle hypertrop. for ECC than Con.*

Hortobagyi et.al., 1996 cont....

- *Neural adaptation: ECC training increas. EMG activity during ECC testing about 7 times more than con. trng.*
- *1) untrnd. indiv. showed incomplete muscle activation (EMG analysis)*
- *2) Incomplete muscle activ. at the begin. of exercise would bring more room for neural adapt.*
- *Several mechan. to increase EMG activ.:selec. recruit. of type II muscle fibers / greater recruit. of MU.*

CONCLUSIONS.....

- *Ecc. and Ecc/Con training seems to bring about greater gains in strength when compared to Con.trng alone.*
- *Mechanisms: a) neural adaptation (activ. of more MU after trng thus increas. IEMG activ.)*
- *b) selective recruitment of type II fibers/ hypertrophy.*
- *Different fatigue responses for ECC and Con.*

