D. SCHMIDTBLEICHER

Modern strength training of youth

Dietmar Schmidtbleicher

Age and gender related training

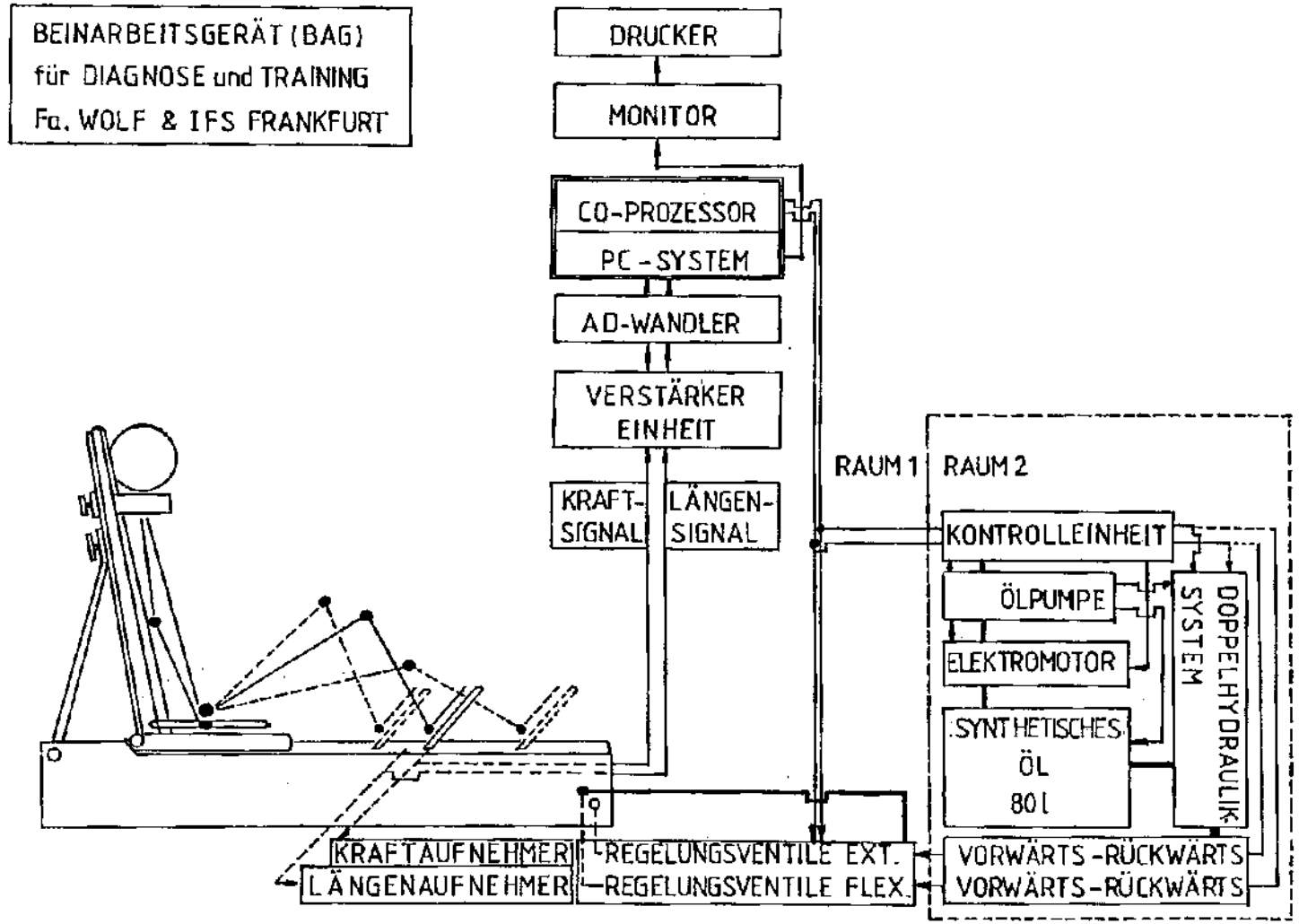
Strength training with children

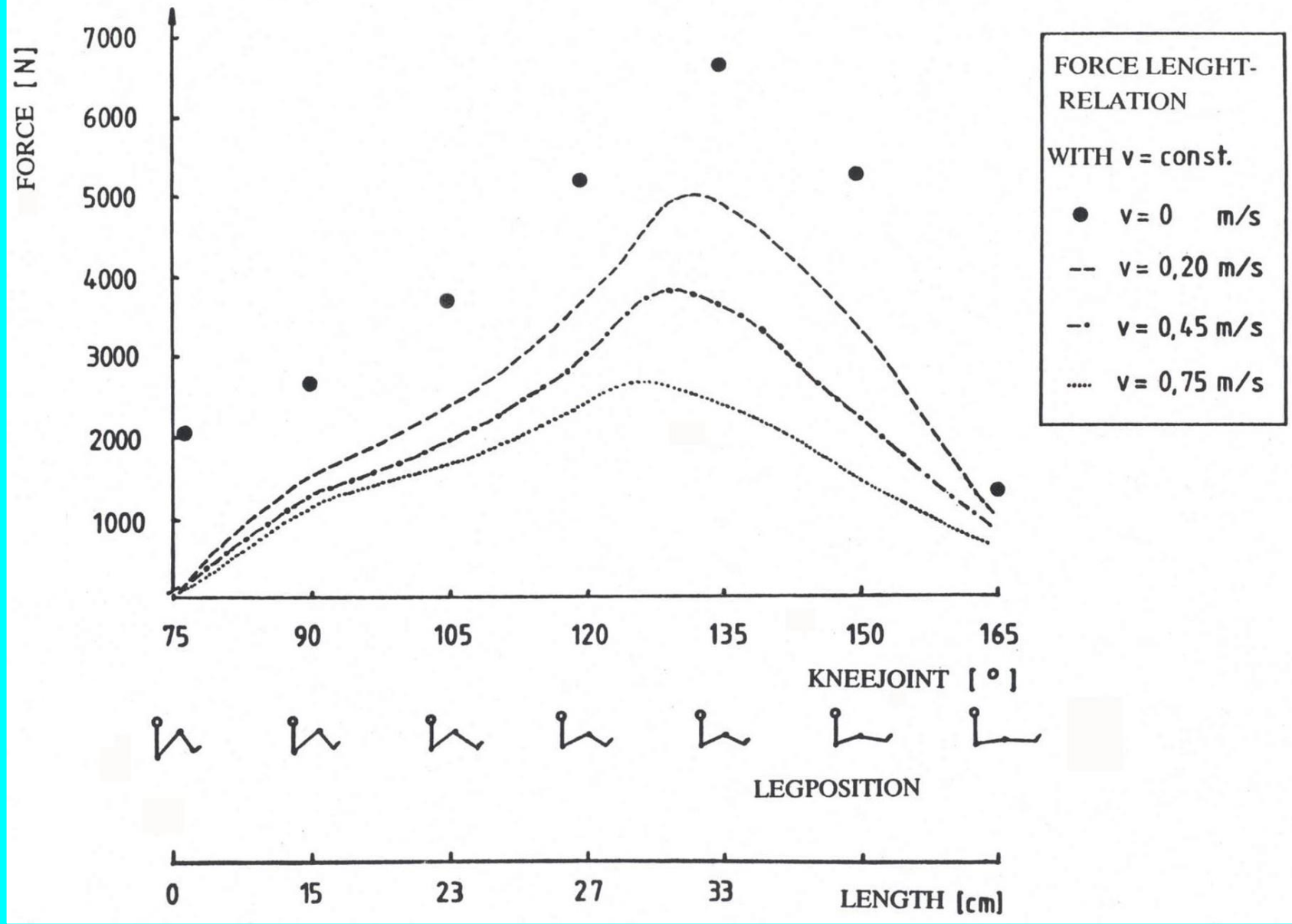
1. Fast increase in all strength components is possible
2. Increasing the strength performance capabilities increases the performance in a lot of sports and disciplines
3. Improvement in skills enhance the motivation
4. A given level of strength often is a prerequisite to fullfill the demands of a skill (for example: hurdles)

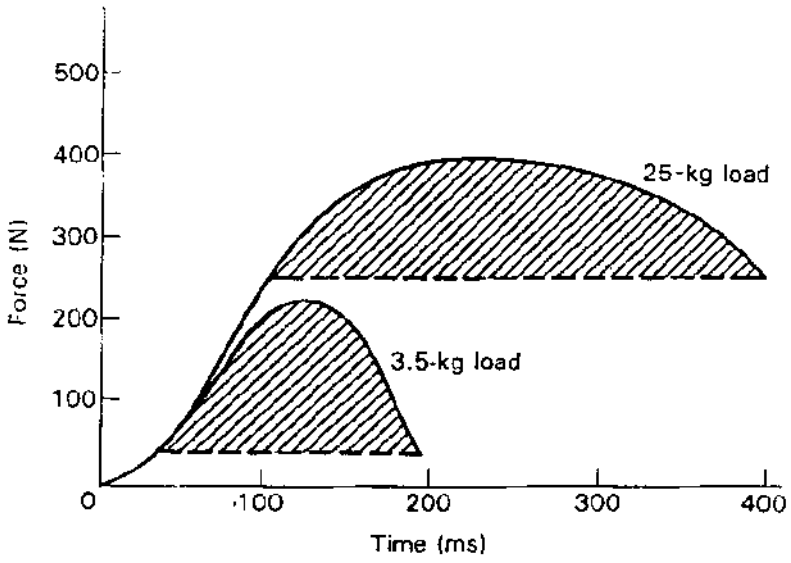
Strength training with children

5. A given level of strength can avoid frustration by diminuishing the number of unsuccessful attempts
6. As a consequence the training process is more effective
7. Strength training can reduce the risk of injury
8. Strength training can reduce the risk of orthopedical weakness

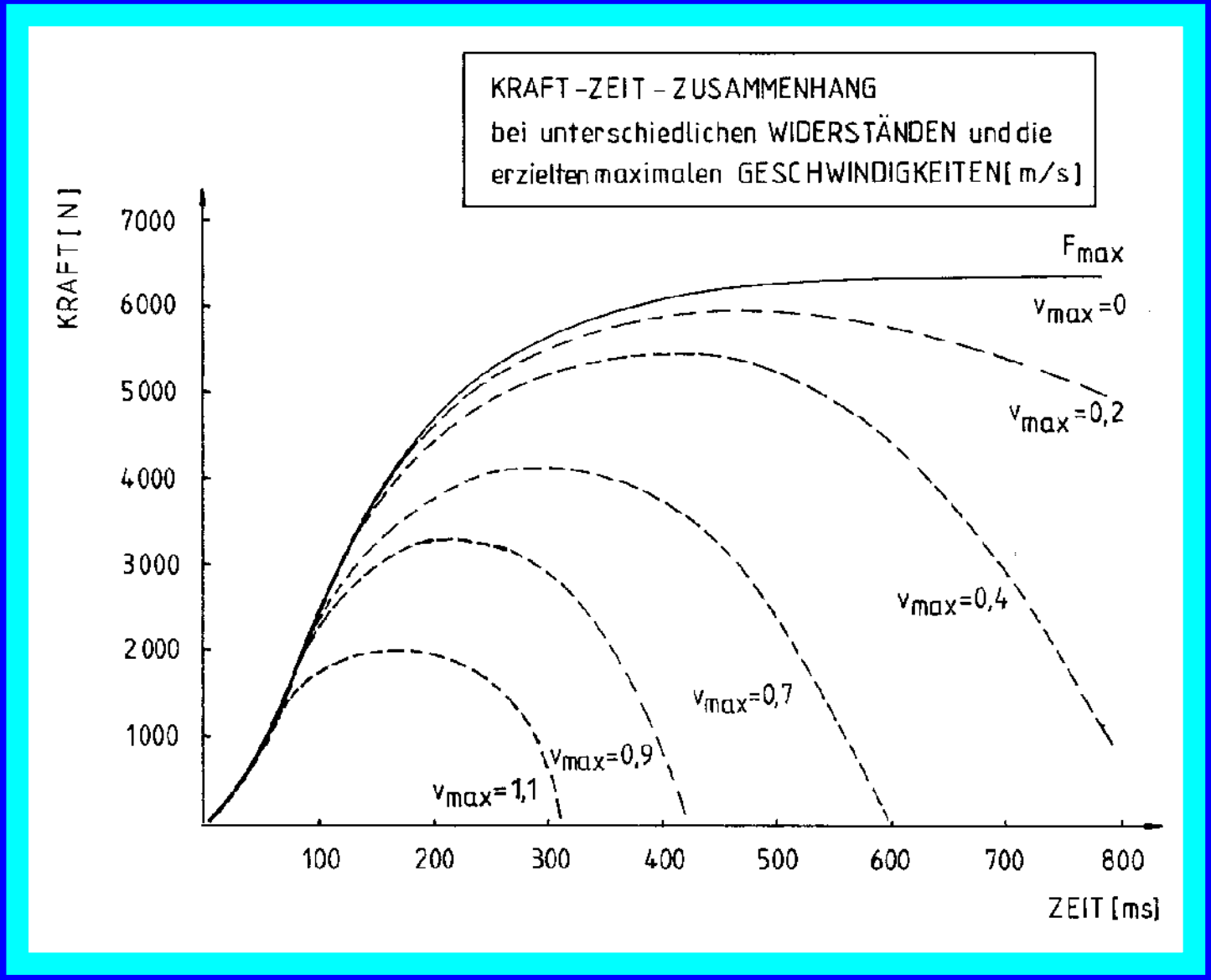
Structure

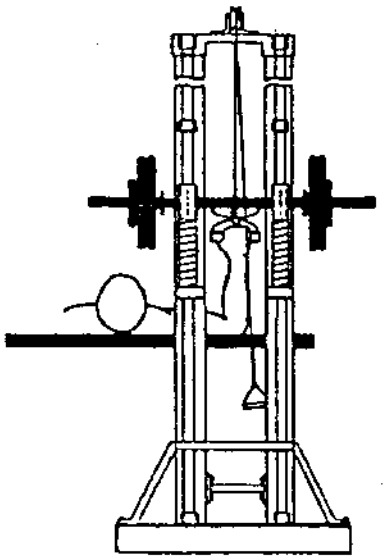

BEINARBEITSGERÄT (BAG)
für DIAGNOSE und TRAINING
Fa. WOLF & IFS FRANKFURT
DRUCKER
MONITOR
CO-PROZESSOR
PC-SYSTEM
AD-WANDLER
VERSTÄRKER EINHEIT
KRAFT-SIGNAL
LÄNGEN-SIGNAL
RAUM 1
RAUM 2
KONTROLLEINHEIT
ÖLPUMPE
ELEKTROMOTOR
SYNTHETISCHES ÖL 80 l
DOPPELHYDRAULIK-SYSTEM
KRAFTAUFNEHMER
LÄNGENAUFNEHMER
REGELUNGSVENTILE EXT.
REGELUNGSVENTILE FLEX.
VORWÄRTS-RÜCKWÄRTS
VORWÄRTS-RÜCKWÄRTS


FORCE [N]
7000
6000
5000
4000
3000
2000
1000
FORCE LENGHT-
RELATION
WITH v = const.
v = 0 m/s
v = 0,20 m/s
v = 0,45 m/s
v = 0,75 m/s
75
90
105
120
135
150
165
KNEEJOINT [°]
LEGPOSITION
0
15
23
27
33
LENGTH [cm]

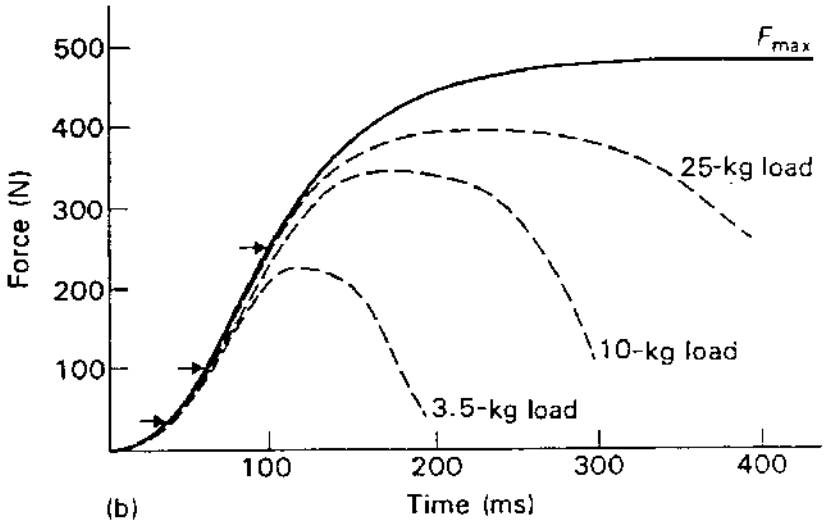


Force–time curves of concentric actions against different loads. The shaded areas describe the acceleration impulse, which is mainly due to the rate of fone development (RFD) in lower loads and therefore faster movements. In higher loads the impulse is mainly determined by the maximum strength that can be exerted against this resistance.


KRAFT-ZEIT-ZUSAMMENHANG
bei unterschiedlichen WIDERSTÄNDEN und die
erzielten maximalen GESCHWINDIGKEITEN [m/s]
KRAFT [N]
7000
6000
5000
4000
3000
2000
1000
Fmax
vmax=0
vmax=0,2
vmax=0,4
vmax=0,7
vmax=0,9
vmax=1,1
100
200
300
400
500
600
700
800
ZEIT [ms]



(a)



(b)

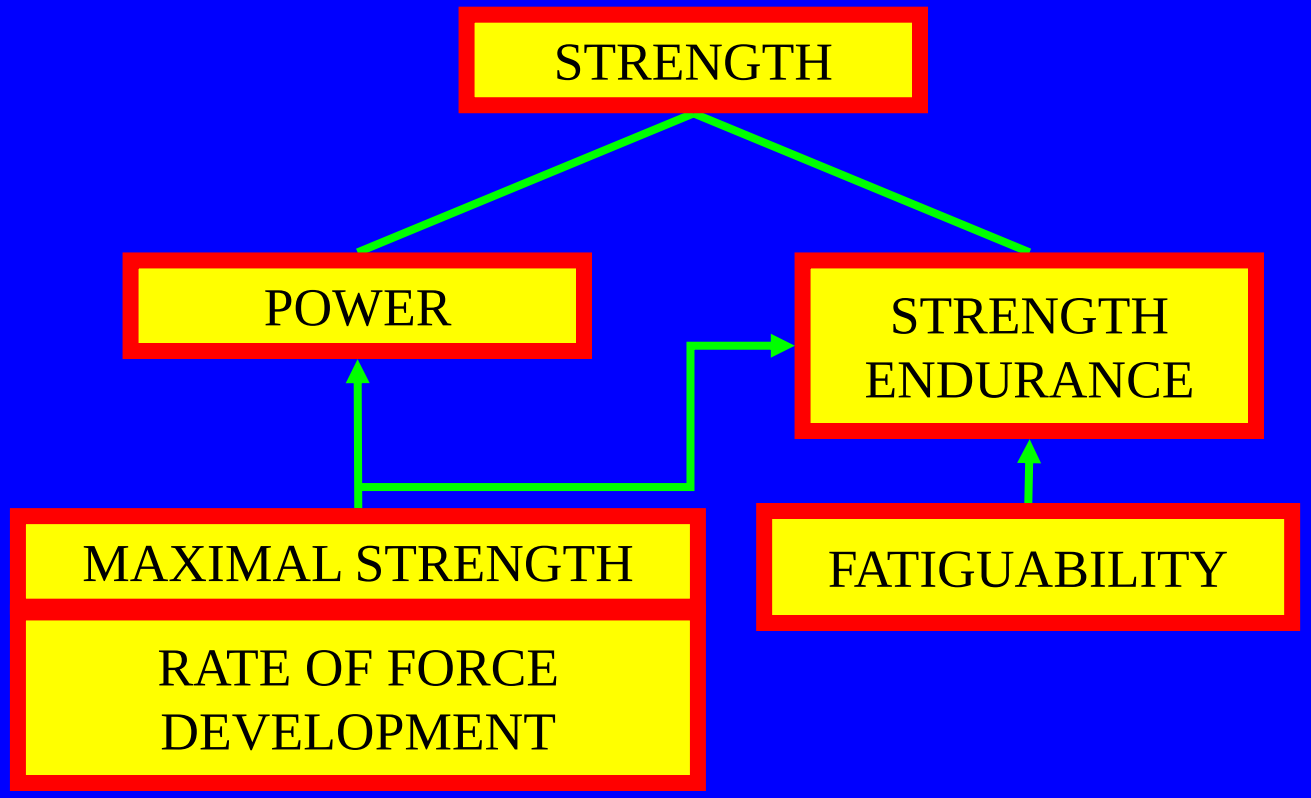
Load (kg)	Correlation
25	$r = 0.85$
10	$r = 0.66$
3.5	$r = 0.50$

(c)

(a) Measurement device for the registration of force–time curves. (b) Force–time curves from isometric and concentric actions against different loads of a shot put-like arm movement of one subject. The dashed lines show the concentric phase of the movement. The solid line describes the isometric part of the muscle action. (c) Correlations between strength and movement time of different loads.

Structure and components of strength (2012)

MOTOR ABILITY



COMPONENTS

Physiology of strength

Structure and components of strength (2012)

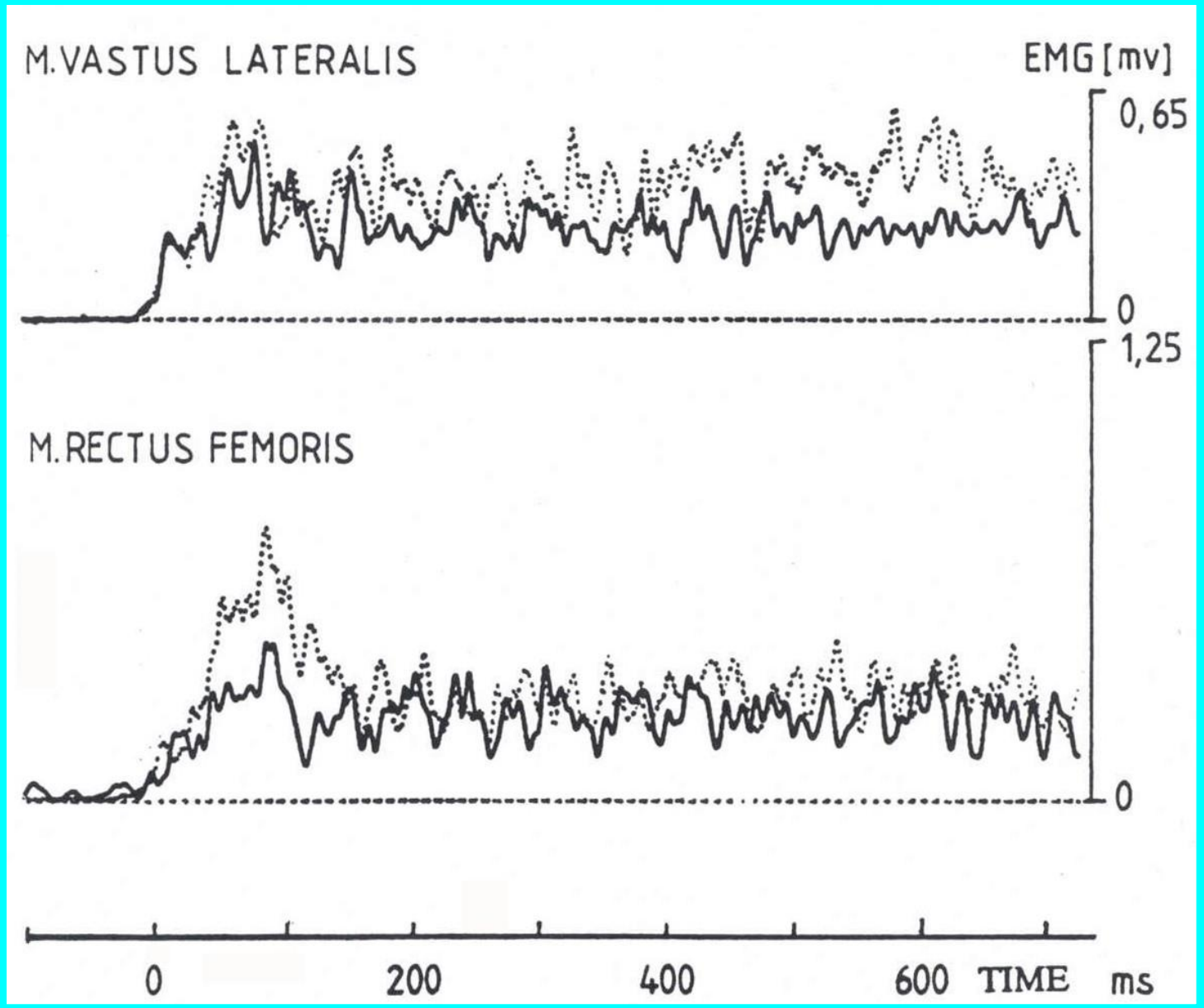
Morphological and physiological factors

Nervous System
- recruitment
- frequency
- synchronisation
- reduction of inhibitation
- reflexivity

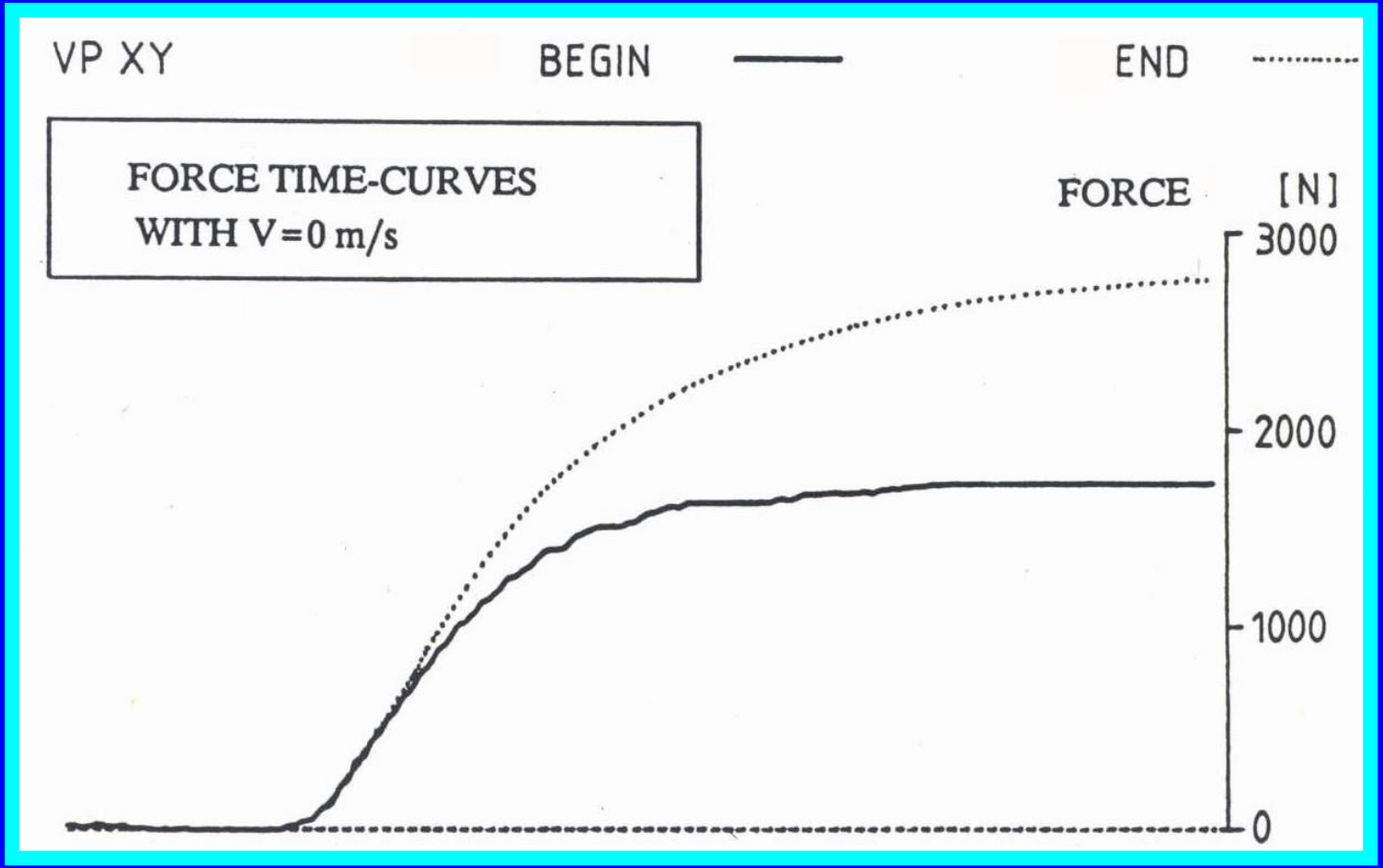
Muscle System
- cross sectional area
- fiber composition
- fiber hypertrophy
- metabolic capacity
- elasticity of muscle and tendon

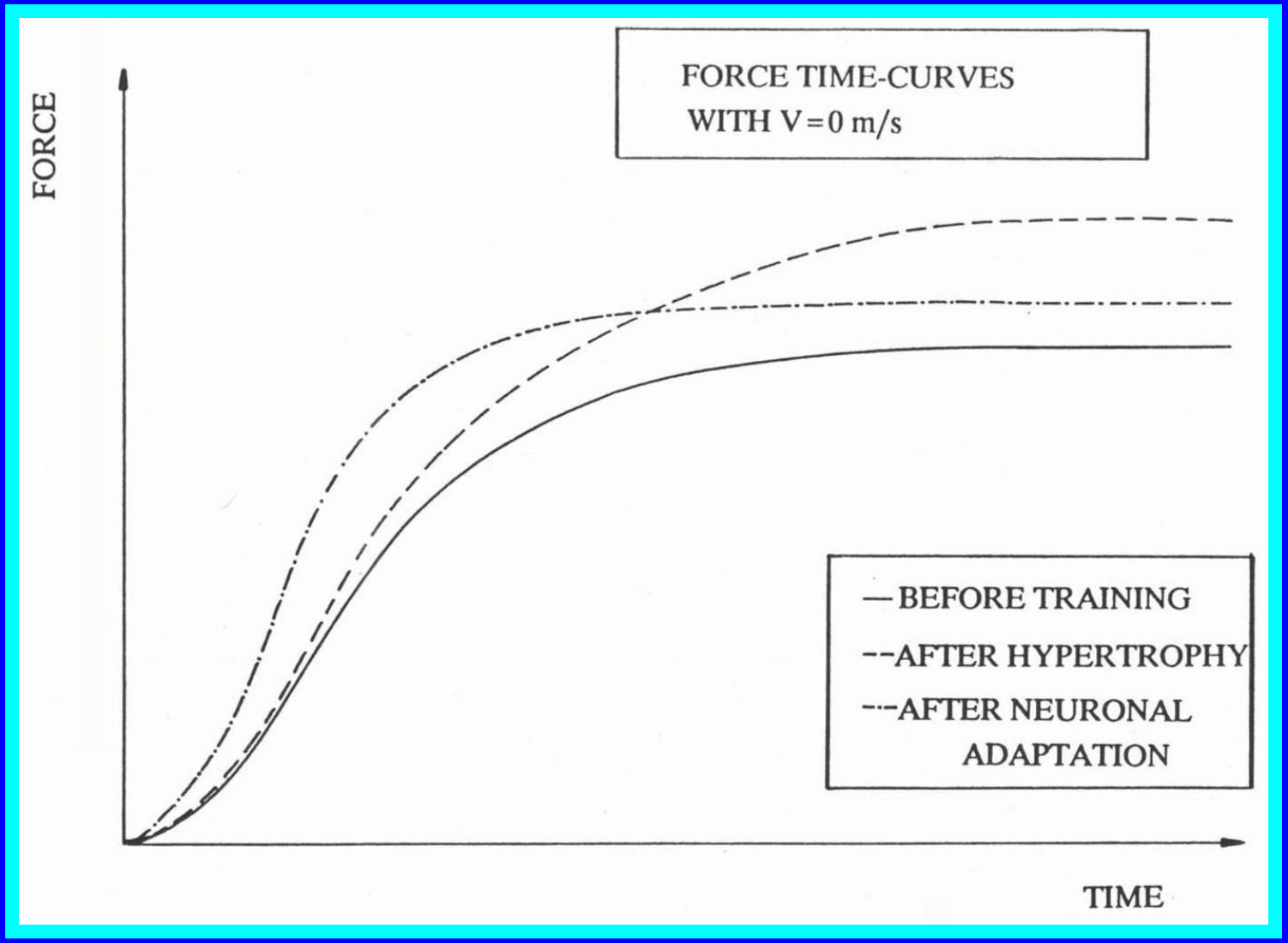
Classification of training methods

	Maximal contractions	Adaptations	
Load intensity	90 – 100%	Muscle mass	+
Repetitions	1 – 3	Utilisation of muscle potential	+++
Sets	3	Force maximum	++
Rest intervall	5 min	Rate of force development	+++
contraction speed	explosiv	Preactivation	++
Number of workouts per week	2 – 3	Reflex activity	
duration of the period	6 – 8		


M.VASTUS LATERALIS
EMG [mv]
0,65
0
1,25
M.RECTUS FEMORIS
0
0
200
400
600
TIME
ms

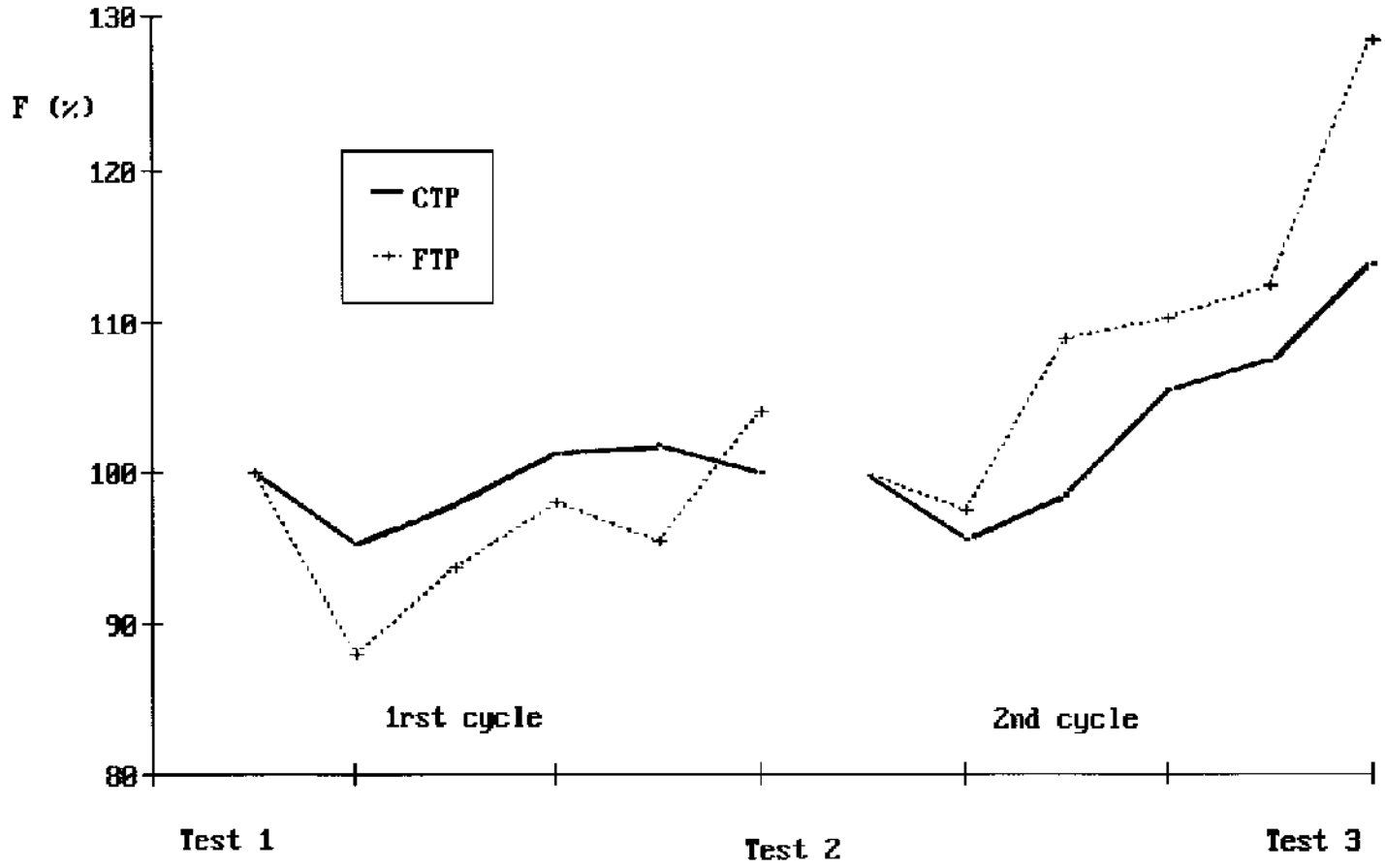
	Submaximal contractions	Adaptations	
Load intensity	70 – 75%	Muscle mass	+++
Repetitions	8 – 12	Utilisation of muscle potential	+
Sets	5	Force maximum	+++
Rest intervall	2 - 3 min	Rate of force development	+
contraction speed	slow to rapid	Preactivation	+
Number of workouts per week	2 – 3	Reflex activity	
duration of the period	10-12		


VP XY
BEGIN
END
FORCE TIME-CURVES
WITH V=0 m/s
FORCE [N]
3000
2000
1000
0


FORCE TIME-CURVES
WITH V = 0 m/s
FORCE
TIME
— BEFORE TRAINING
--AFTER HYPERTROPHY
-·-AFTER NEURONAL
ADAPTATION

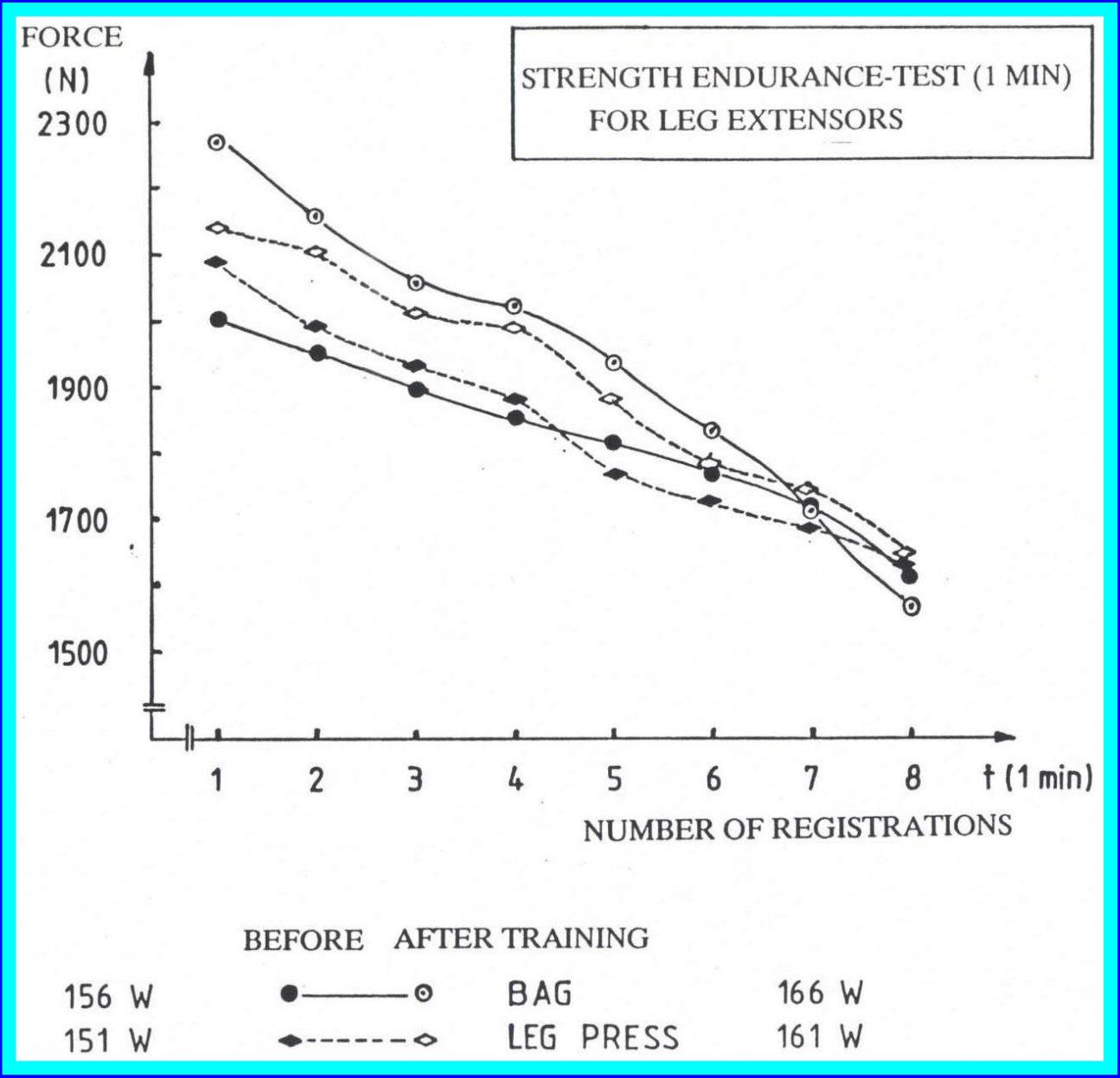
Hypertrophy Training for Females

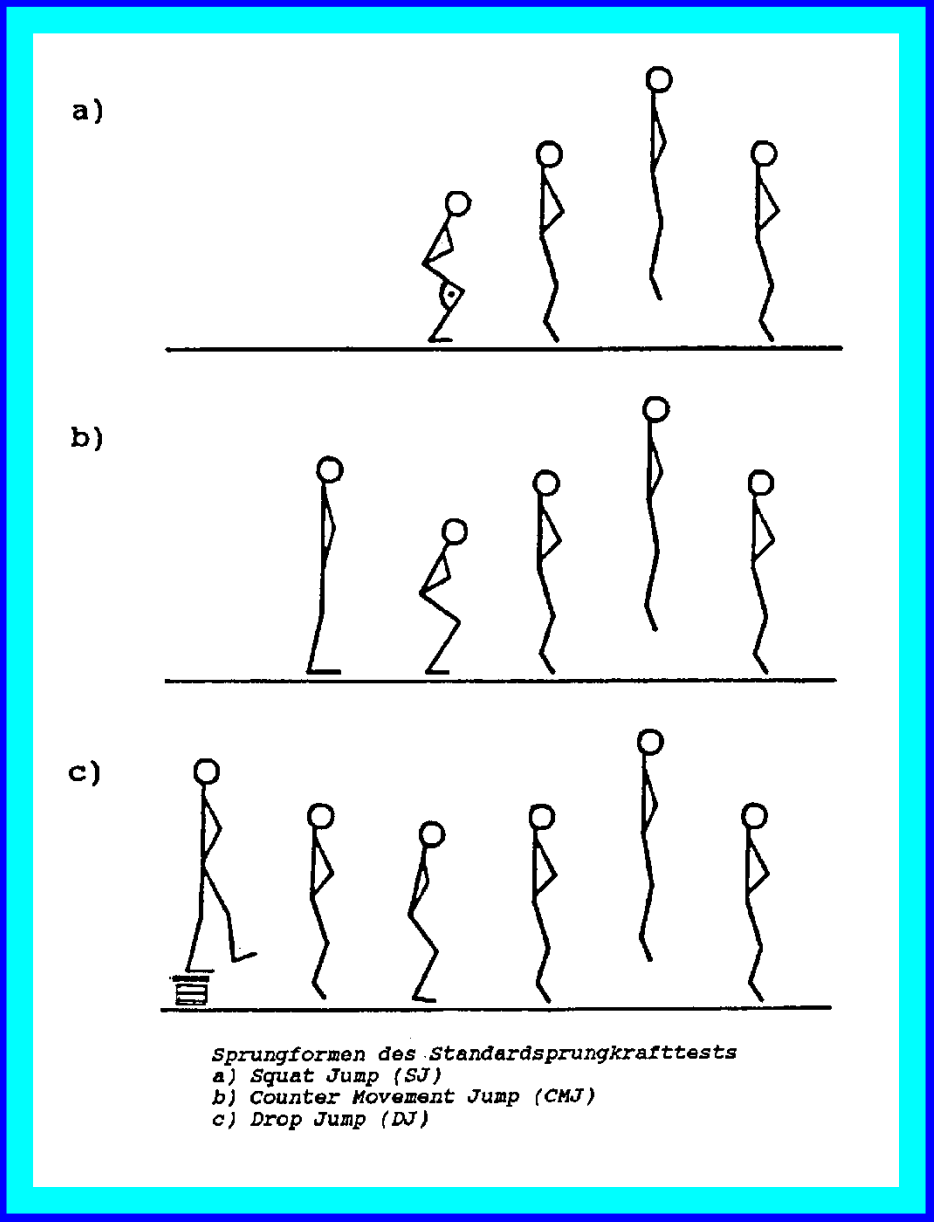
	Cyklus 1	Cyklus 2
Group 1		
Left Leg	Specific Training	Male Training
Right Leg	Male Training	Specific Training
Group 2		
Left Leg	Male Training	Specific Training
Right Leg	Specific Training	Male Training



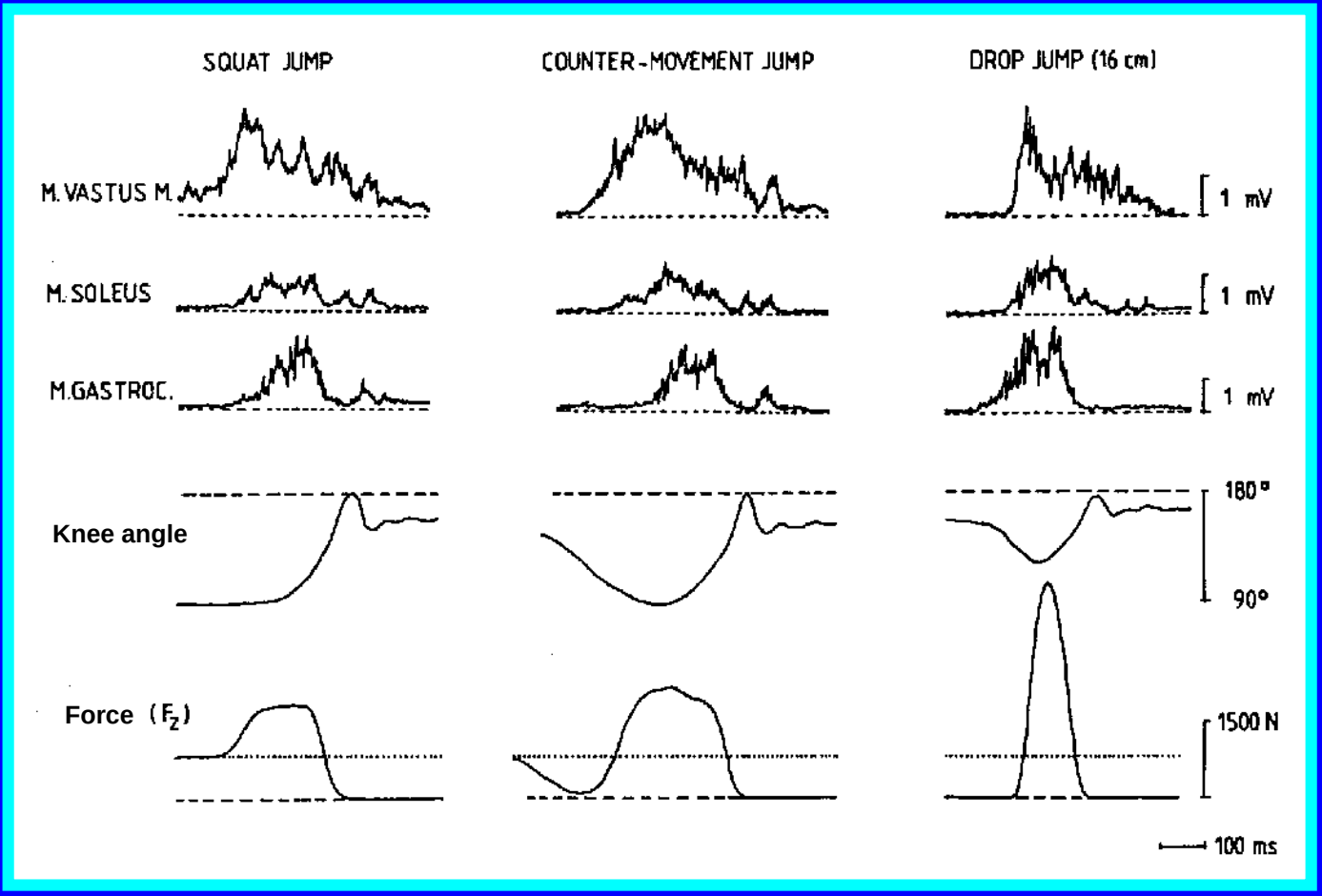
Development of maximal strength over both menstrual cycles
(result at the beginning of each cycle = 100 %)

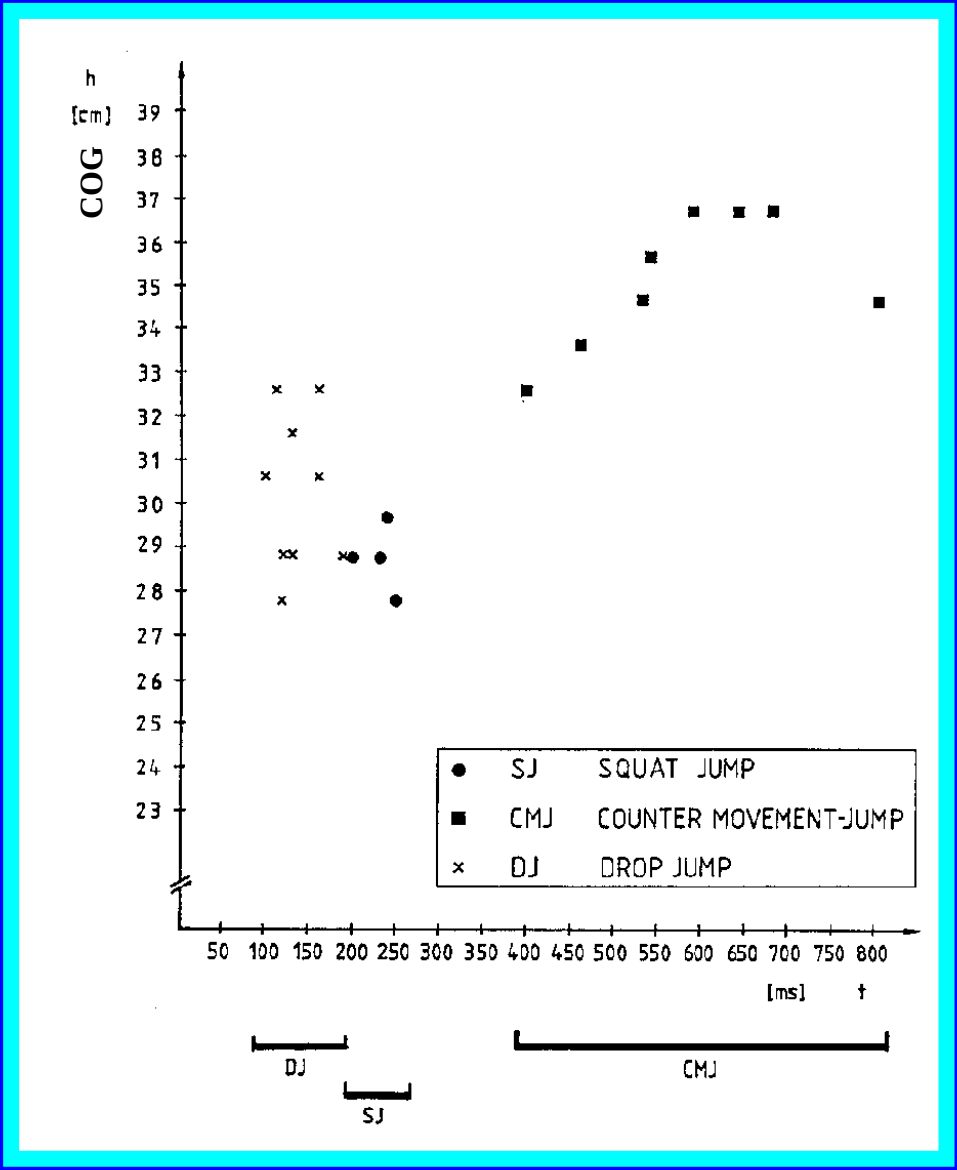
	Strength endurance methods	**Adaptations**	
Load intensity	60%	Muscle mass	++
Repetitions	20	Enzymatic adaptations	++
Sets	4	Mitochondrial adaptations	-
Rest intervall	0,5 – 1 min	Resistance against neuronal fatigue	++
contraction speed	langsam		
Number of workouts per week	2 – 3		
duration of the period	4		


FORCE
(N)
2300
2100
1900
1700
1500
STRENGTH ENDURANCE-TEST (1 MIN)
FOR LEG EXTENSORS
1
2
3
4
5
6
7
8
t (1 min)
NUMBER OF REGISTRATIONS
BEFORE AFTER TRAINING
156 W
151 W
BAG
LEG PRESS
166 W
161 W

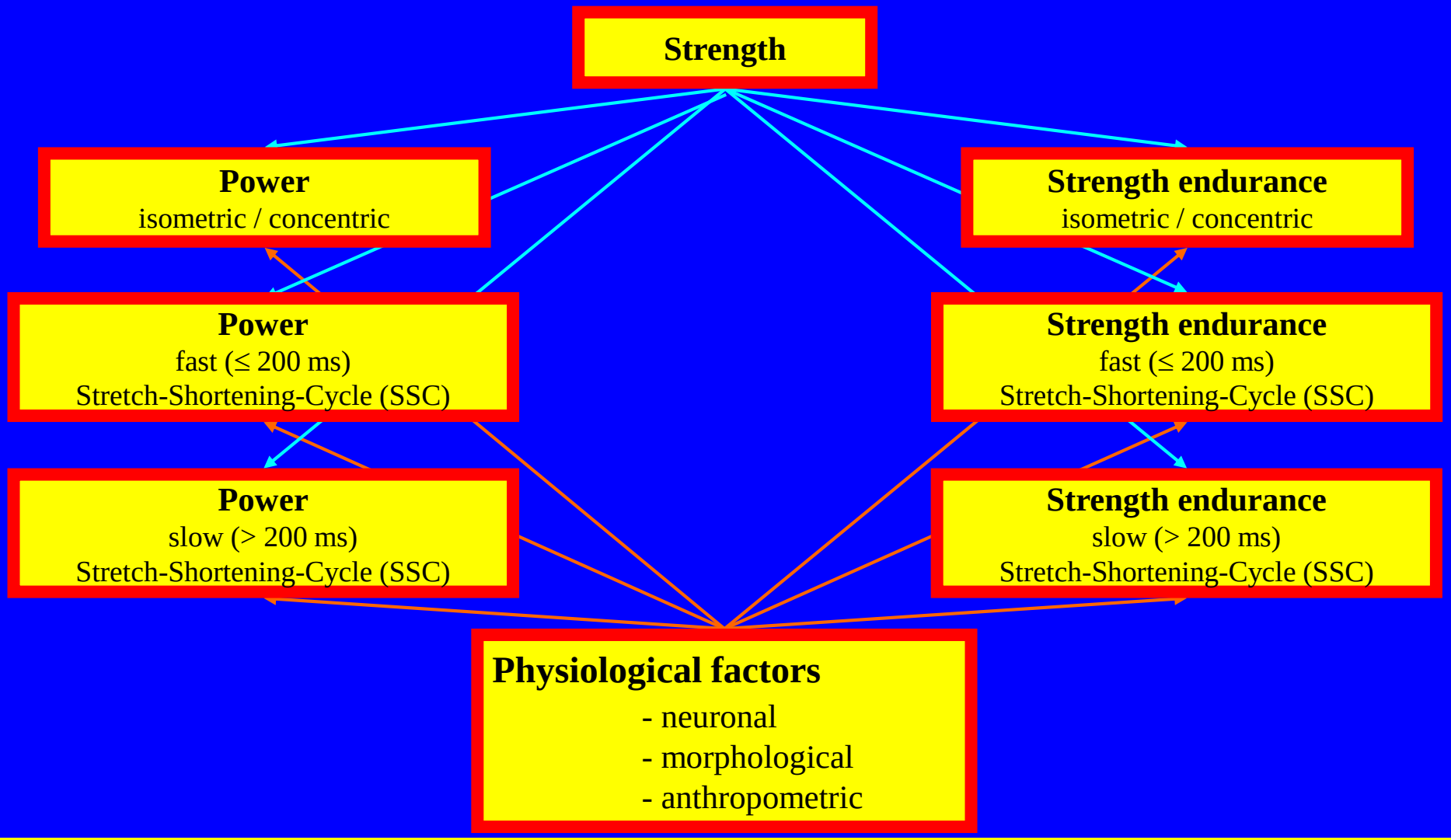


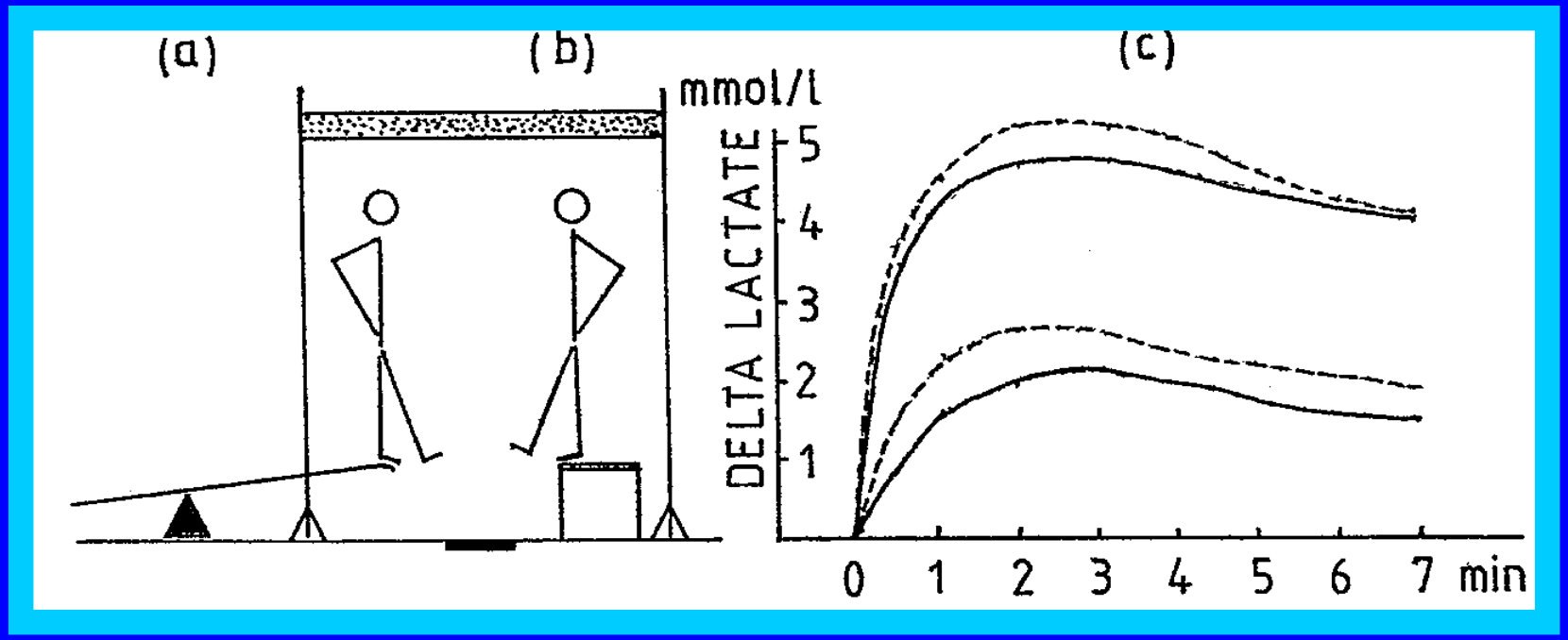
Sprungformen des Standardsprungkrafttests
a) Squat Jump (SJ)
b) Counter Movement Jump (CMJ)
c) Drop Jump (DJ)

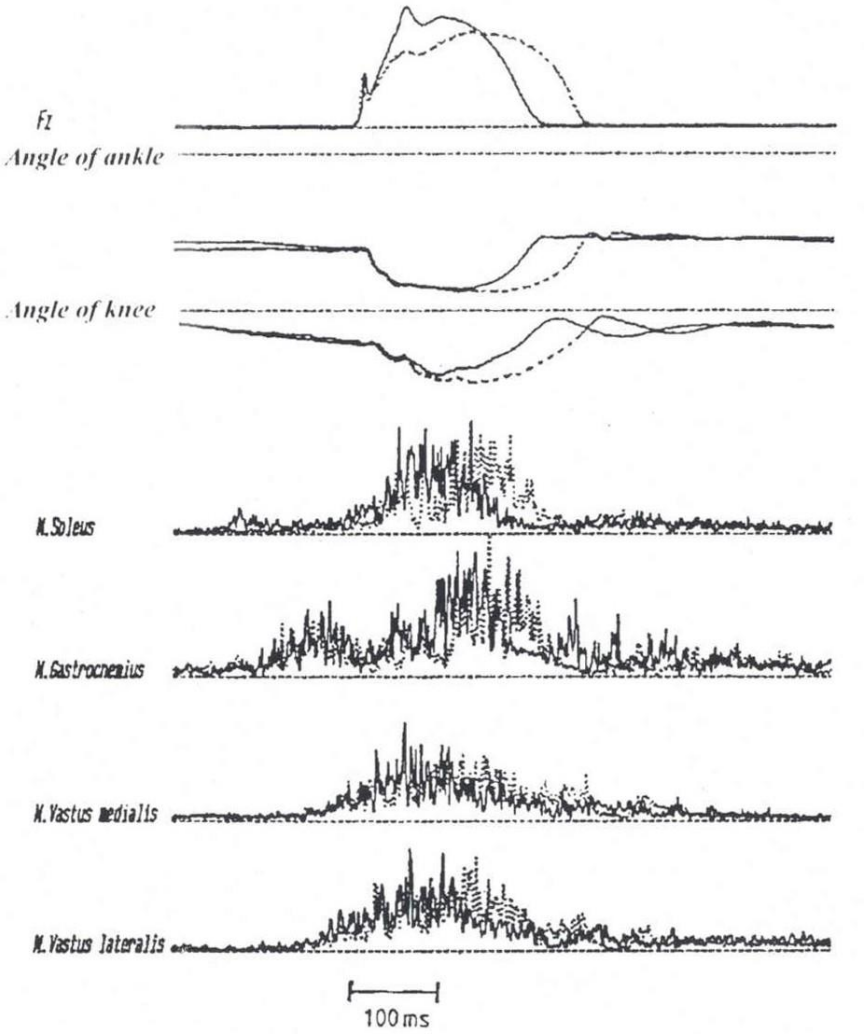

SQUAT JUMP
COUNTER-MOVEMENT JUMP
DROP JUMP (16 cm)
M. VASTUS M.
M. SOLEUS
M. GASTROC.
1 mV
1 mV
1 mV
Knee angle
180°
90°
Force (F_z)
1500 N
100 ms


h
[cm]
COG
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
SJ SQUAT JUMP
CMJ COUNTER MOVEMENT-JUMP
DJ DROP JUMP
50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800
[ms] t
DJ
SJ
CMJ

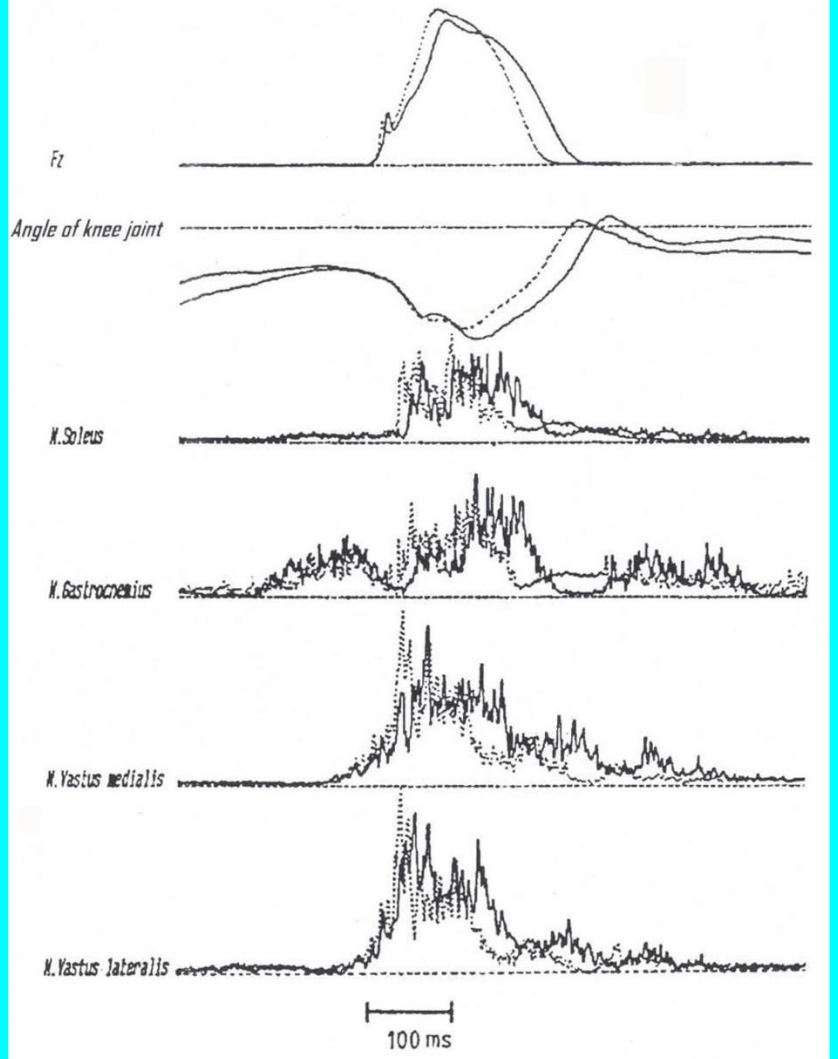
Structure and Components of Strength (2012)




(a)
(b)
(c)
mmol/l
DELTA LACTATE
5
4
3
2
1
0 1 2 3 4 5 6 7 min

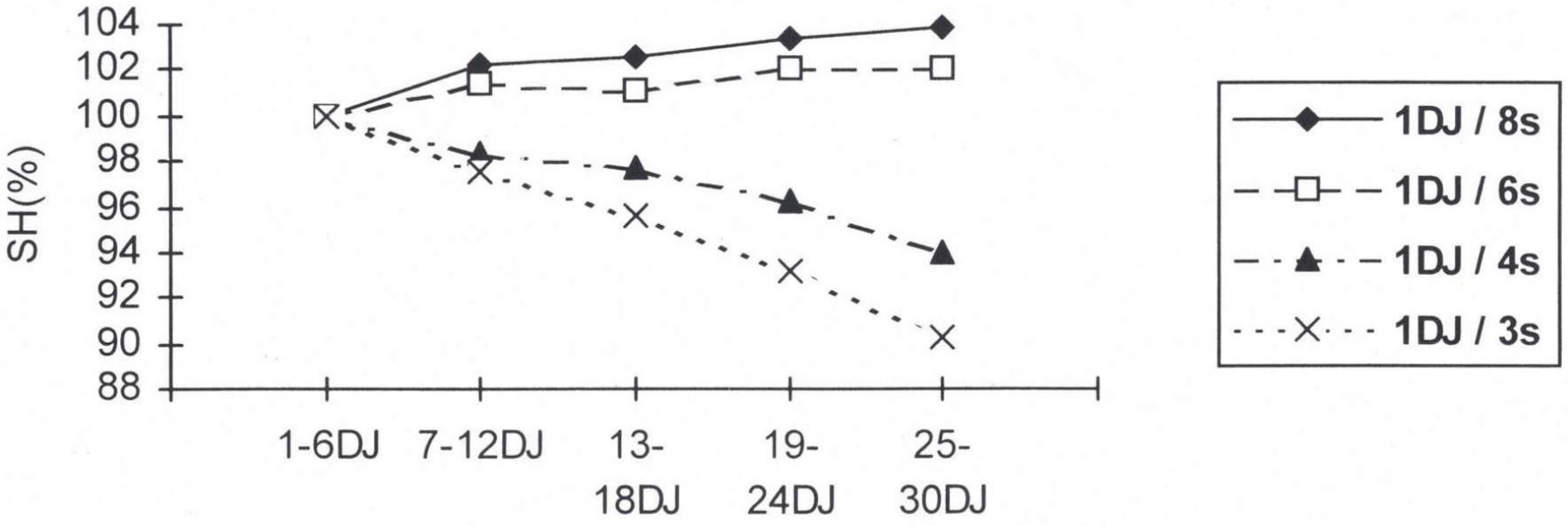


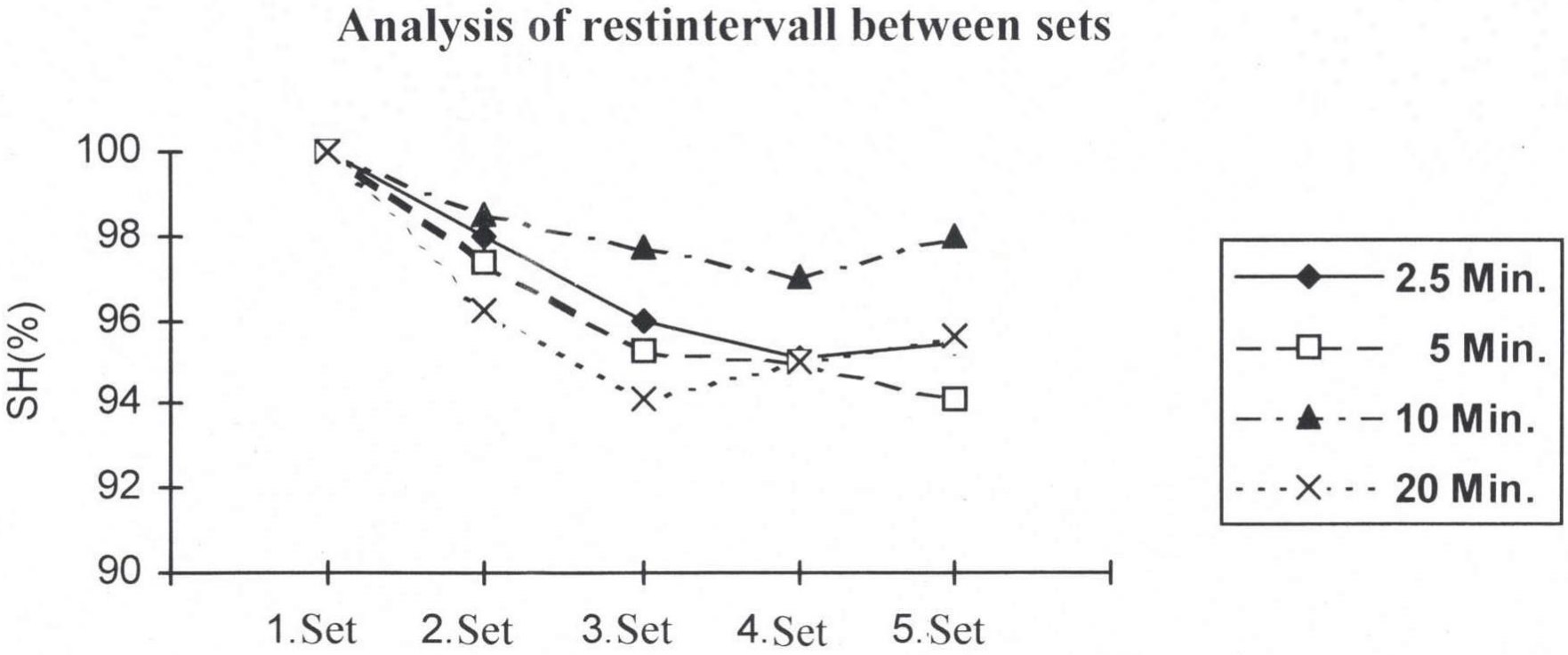
Fatigue-test in drop-jumps
solid line = first 10 jumps
dotted line = last 10 jumps



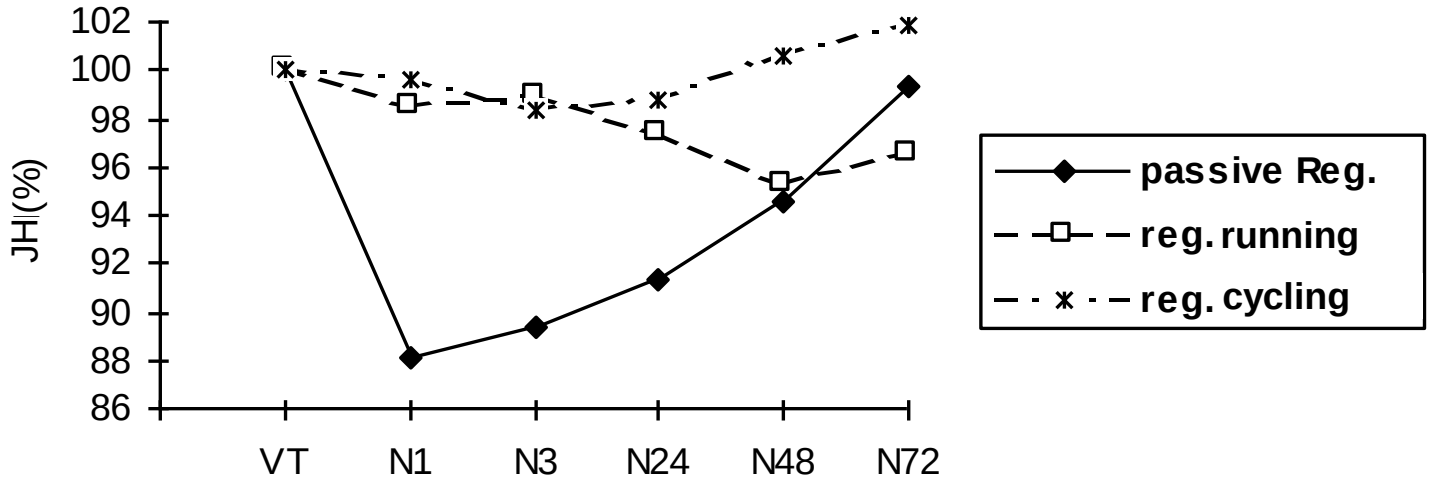
Fatigue-test in drop-jumps
solid line = first 10 jumps
dotted line = last 10 jumps

Mean of jumping hight (SH; mean of first 6 jumps (of a set including 30 jumps) = 100%) in dependence of intraseriel rest period




Analysis of restintervall between sets
100
98
96
94
92
90
SH(%)
1.Set
2.Set
3.Set
4.Set
5.Set
2.5 Min.
5 Min.
10 Min.
20 Min.

Change of jumping performance after training – dependency on the kind of regenerative intervention



Training methods for power in stretch shortening-cycles (SSC)

Frequency of jumps	every 6 s
Number of jumps per set	10-12
Number of sets	3-5
Rest interval	10 min
Training units per week	2-3

Strength circle for the upper part of the body

- Bench press
- Bench rowing
- Shoulder press
- Lat pulldown
- Butterfly
- Butterfly reverse

} neuromuscular

hypertrophy

Strength circle for the legs

- Leg press
- Hamstrings
- Abductors
- Adductors

} neuromuscular hypertrophy

Core stabilisation

- Crunches (straight)
- Back extension (right arm / left leg)
- Crunches (left shoulder / right knee)
- Trunk extension (left arm / right leg)
- Crunches (right shoulder / left knee)
- Lateral flexion right
- Lateral flexion left
- UP/Down - Flexion and Extension - alternating Arms and Legs

Endurance with enhanced load

- Flexibility for the trunk muscle
- Specific skills – upright standing

Specific strength training

<table>
<tr><td colspan="7">Warm Up (general / specific)</td></tr>
<tr><td colspan="7">Technique / Tactic (sportspecific)</td></tr>
<tr><td colspan="6">Hypertrophy</td><td rowspan="3">Gerneral endurance</td></tr>
<tr><td colspan="3">Single joint movement</td><td colspan="3">Multi joint movements</td></tr>
<tr><td>Legs</td><td>Trunk</td><td>Arms</td><td>Legs</td><td>Trunk</td><td>Arms</td></tr>
<tr><td colspan="7">Cool Down / Regeneration</td></tr>
</table>

<table>
<tr><td colspan="4">Warm Up (general / specific)</td></tr>
<tr><td rowspan="2">Neuronal adaptations
- RFD
- Maximal strength</td><td colspan="2">Stretch-Shortening-Cycle</td><td>Specific strength</td></tr>
<tr><td>slow</td><td>fast</td><td>General speed</td></tr>
<tr><td colspan="4">Technique / Tactic (sportspecific)</td></tr>
<tr><td colspan="4">Cool Down / Regeneration</td></tr>
</table>

Strength circle for the upper part of the body

- Bench press
- Bench rowing
- Shoulder press
- Lat pulldown
- Butterfly
- Butterfly reverse

} neuromuscular

hypertrophy

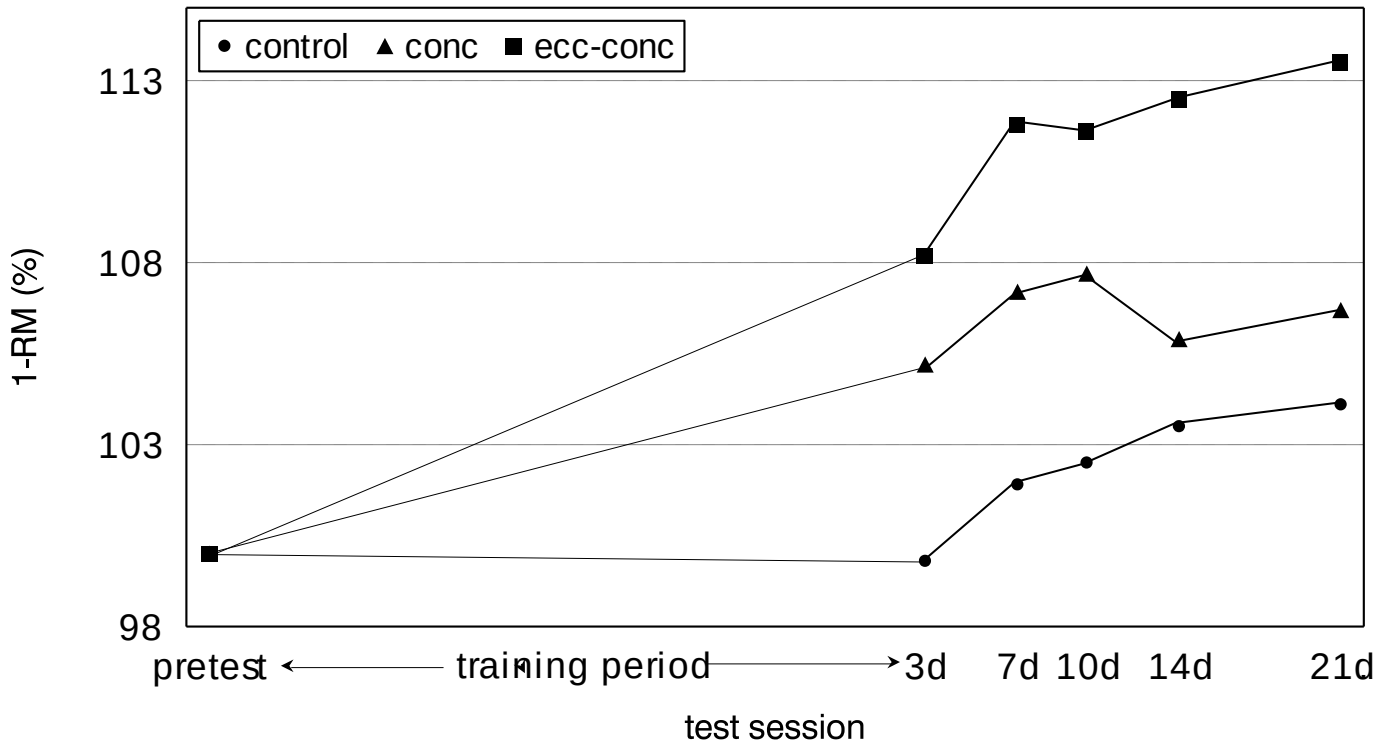
Strength circle for the legs

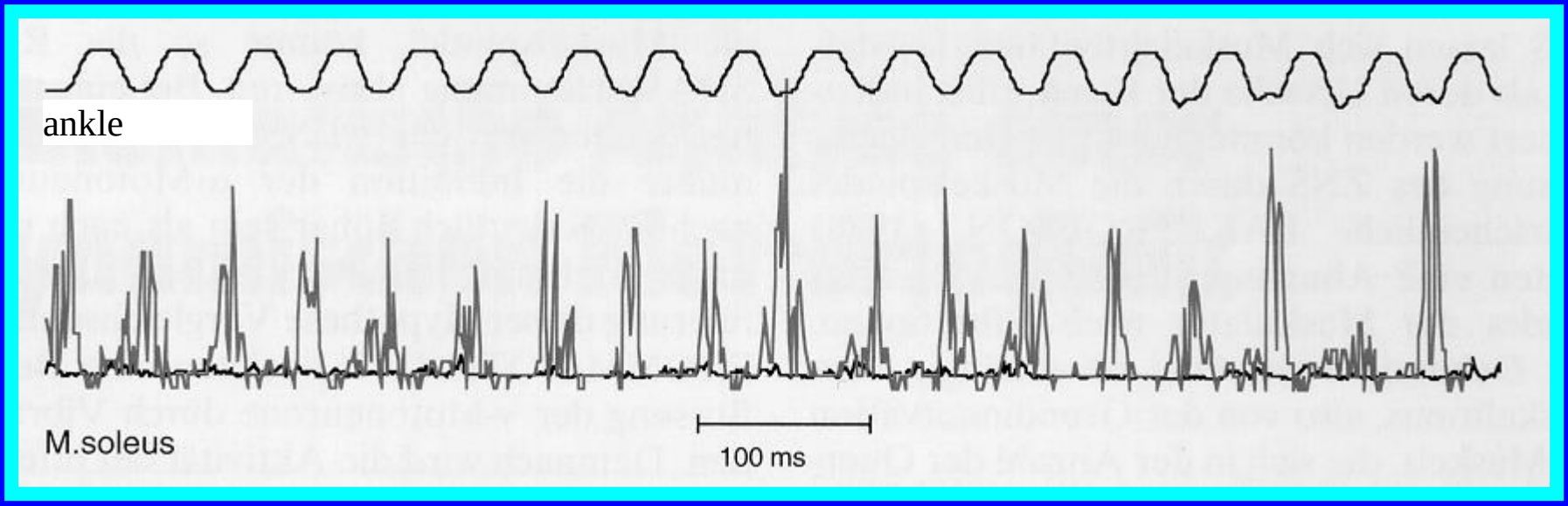
- Leg press
- Hamstrings
- Abductors
- Adductors

} neuromuscular hypertrophy

Time Course of Detraining

one-repetition-maximum

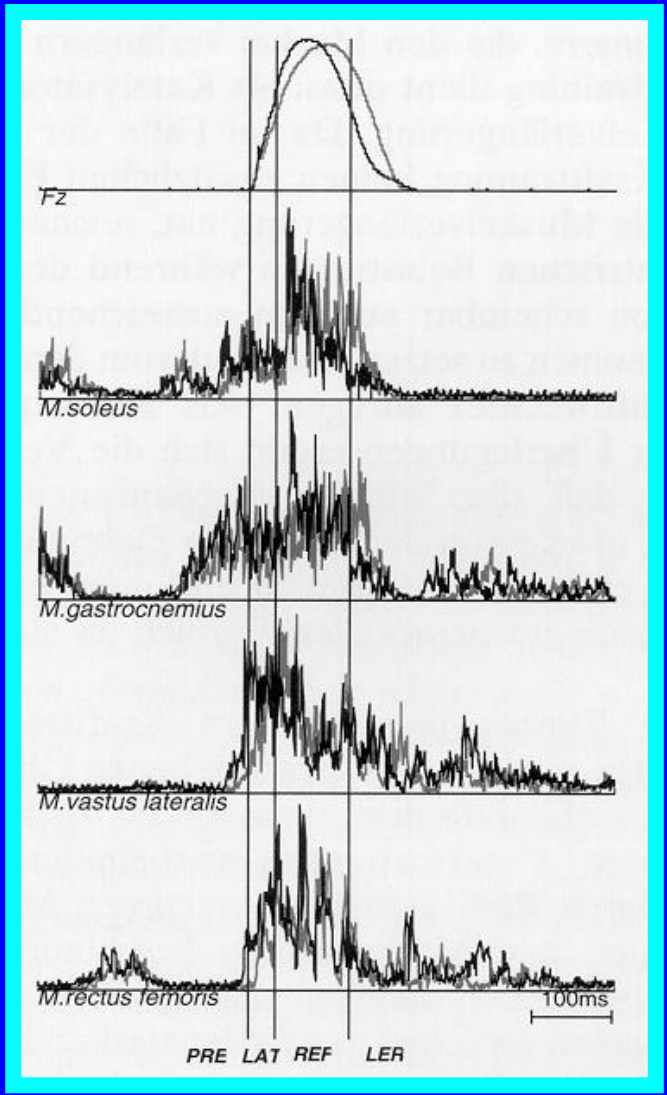



ankle
M.soleus
100 ms

ZEPTOR-*med* ®

Characteristics:

- 3 Dimensional Oscillation
- Multiple Dregrees of Freedom
- Stochastic Input +/- 1Hz / s


Fz
M.soleus
M.gastrocnemius
M.vastus lateralis
M.rectus femoris
100ms
PRE LAT REF LER