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Machine-Based Pelvic Floor Muscle Training
Is it possible?

Autoren:

A Stephan
B Schulte-Frei

MACHINE-BASED PELVIC FLOOR MUSCLE TRAINING – IS IT POSSIBLE?

Anika Stephan[1], Birgit Schulte-Frei[2]
[1]Kieser Training AG, Research & Development, anika.stephan@kieser-training.com, Zurich
[2]ProPhysio Köln, Europa Fachhochschule Fresenius

INTRODUCTION

Whether it is possible to strengthen the pelvic floor muscles with training machines is a question that has not been seriously looked at to date. With some 24% of Germans suffering from urinary incontinence (1), it would be quite significant if such a method could be found, particularly since over 6% of Germans are already members of fitness clubs (2). Putting incontinence patients through a machine-based resistance training program would be easier than the known and practiced pelvic floor strengthening regimes.
The aim of this study was to examine the use of pelvic floor muscles (PFM) in machine-based resistance exercises under two conditions: regular training (RT) and active pelvic floor contractions during the concentric phase of each repetition ($APFC_{con}$). The results are discussed and reflect pelvic floor activity levels at rest and with APFC during lying, sitting, and standing.

METHODS

The study involved 6 females (height: 167.7 (±8.2) cm, weight: 64.5 (±11) kg, age: 33 (±6.7) years) without pelvic floor problems and no pathological findings using a multi-activity test (3). All had performed machine-based weight training before, although not all regularly and not necessarily on the machines used in the study.
The following resistance training machines were used to examine the potential involvement of the PFM: hip adduction (HA), knee flexion in prone position (KF), hip extension in lateral position (HE), hip flexion in lateral position (HF), and leg press (LP). The HA and LP were done with a backrest in both steep and flat positions. Therefore, the subjects did 7 different exercises in each of the RT and $APFC_{con}$ modes. Training intensity was 55% of 1 repetition maximum (RM). Each repetition lasted 8 seconds (4 concentric / 4 eccentric) and 8 continuous repetitions were recorded. We recorded surface electromyograms (EMGs) of the PFM (Innocept Stimpon vaginal probe), m. obliquus internus, m. rectus abdominis, m. gluteus maximus and m. adductor using NORAXON® Telemyo 2400T and a bandwidth of 10-500 Hz. Signals were A/D converted with 1500 Hz and stored in MyoResearch XP software followed by ECG reduction, full wave rectification, smoothing with RMS 100 ms and amplitude normalization to the highest activity level during Maximum Voluntary Contraction (MVC) detected from 5 different MVC tests. The mean EMG-curves of subjects were imported into MyoResearch XP normative groups. SPSS® 15.0 was used for the statistics.

RESULTS

RT results showed mean PFM activity of 19%-25% of the highest activity level during MVC for all machine-based exercises, but $HA_{steep/flat.}$ $APFC_{con}$ increased mean activity levels during those exercises to 27-29%. Mean EMG-elevations through $APFC_{con}$ were statistically significant for all exercises except for LP_{flat} (all $p \leq 0.05$; Wilcoxon). Activation was much higher during the two HA-exercises (Table 1).

Tab. 1: HA_{flat} and HA_{steep} – PFM activity as % of highest activity level during MVC

Exercise	*RT*	*$APFC_{con}$*
	(con / ecc / whole rpt.)	*(con / ecc / whole rpt.)*
HA_{flat}	59±17 / 38±17 / 47±20	69±13 / 40±17 / 53±21
HA_{steep}	51±11 / 30±11 / 40±15	60±9 / 32±11 / 45±17

The positive influence of the flat backrest position was not significant but clearly evident in 3 of the 6 subjects. $APFC_{con}$ led to significantly higher mean and concentric EMG-values than RT during HA (Wilcoxon, $p \leq 0.003$).
For all exercises, mean concentric values were higher than mean eccentric values; with the smallest difference in LP_{flat} (RT: 5%, $APMC_{con}$ 9%) and highest in HA_{flat} (RT: 23%, $APMC_{con}$ 30%).

DISCUSSION

Regular machine-based resistance training offers mostly a PFM activation from 16% - 30%. This lies within the range of APFC during lying, sitting, and standing (see Table 2) which can be taken as typical for regular isolated PFMT. Other, more complex PFMT-exercises such as segmental stabilization or crunch with rotated pelvis might cause higher PFM activation. However, knowledge about such values is scarce.
Machine-based hip adduction showed very high activation levels compared to assumed values for regular isolated PFMT of up to 82% (group mean peak during RT at HA_{flat}). Due to the lack of reference values for traditional PFMT-exercises, the potential advantages of machine-based resistance training are not yet proven but require further attention and research.

Tab. 2: Reference values – activity of the pelvic floor muscle group in % of highest activity level during MVC

Activities	*without APFC*	*with APFC*
Lying	3	25
Sitting	3	30
Standing	8	23

CONCLUSION

We showed that PFMs are clearly involved in tested machine-based exercises. Pelvic floor activation during the concentric phase was at least as high as during isolated APFC. We found remarkable PFM activation during machine-based hip adduction. All the machine-based exercises done in the study allowed an intensification of PFM activity by $APFC_{con}$.
Recommendations for the PFM exercise dosage are based on the principles of exercise physiology for normal skeletal muscle (4). In any case, these are mostly used in machine-based weight training. The activation levels observed during machine-based PFMT seem sufficient for PFM training purposes and so there are several reasons why the suitability of machine-based PFMT for preventive PFM strengthening may be possible and should be tested. In addition, the therapeutic use of machine-based PFMT and the role of coordination training during therapy must also be clarified.

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