

THE COMPARATIVE STUDY OF MUSCLE FORCES AND EMG PARAMETERS IN TWO FORMS OF THE STRENGTH TRAINING

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INTRODUCTION: By a comparative method, the differences and the relationship between the muscle forces and EMG parameters were investigated in two forms of the maximal strength training: the continuous repetition maximum voluntary contraction (MVC) and the interval repetition MVC. This study tried to provide a theoretical foundation and practice reference for the coaches in choosing the means of the strength training scientifically.

METHODS: Sixteen male subjects who volunteered to participate in this study are healthy undergraduates from an institute of physical education. Their mean age is 23 ± 0.89 yr, the mean height 173.37 ± 5.27 cm and the mean body mass 68.96 ± 6.78 kg.

The "continuous repetition MVC" and "interval repetition MVC" in both conditions of static and dynamic were tested for each subject to lift weight with one arm lying on his back. By using AKM upper limbs strength testing system and a sixteen channels of bipolar surface EMG telemetric system, the muscle forces and EMG signals were sampled synchronously with a frequency of 1000 Hz. At each test, the forces and EMG data were collected eight times, then the curves of them were gotten by overlapping the 8-time data.

Four muscles of pectoralis major muscle, the anterior part of the deltoid, the biceps and triceps brachii were detected. The maximal strength, start strength and explosive strength were chosen as the typical parameters of muscular force, and so did 33 EMG parameters as the representatives of the integrated EMG, the differential EMG and the amplitude of smoothed EMG. All the parameters are processed statistically with SPSS 8.0.

RESULTS AND DISCUSSION: The results shown that there was no significant difference in the force parameters between the static "continuous repetition MVC" and "interval repetition MVC". The maximal strength for the static "continuous repetition MVC" is 327.879 ± 63.42 N and the maximal strength for the static "interval repetition MVC" is 325.034 ± 63.73 N; the values for the start strength respectively are 152.642 ± 48.98 N and 150.166 ± 46.67 N, 5.630 ± 2.63 N/ms and 4.735 ± 1.63 N/ms for the explosive strength. Also there were no significant differences in EMG parameters as a whole in static condition (about 70% no difference among 33 EMG parameters).

In dynamic condition, there existed significant differences in the force parameters between "continuous repetition MVC" and "interval repetition MVC" ($p < 0.01$). The values for the maximal strength are respectively 298.051 ± 39.40 N and 306.802 ± 44.14 N, 139.698 ± 42.51 N and 86.123 ± 30.21 N for the start strength, and 2.756 ± 0.65 N/ms and 3.640 ± 0.98 N/ms for the explosive strength. As a whole EMG parameters were found to be significant differences (above 70% out of 33 EMG parameters has significant difference). The results also showed that the values of EMG parameters detected in "interval repetition MVC" were significantly smaller than those in "continuous repetition MVC" ($p < 0.05$).

In all of four test conditions, the muscle activated orders were similar for individuals, but significantly different from person to person. The correlation level of EMG and the force parameters was dominantly in medium to low (above 93% out of 90 EMG-force relationship).

CONCLUSION: Based on the facts that we can conclude:

1) There were no significant differences of the force parameters between "continuous repetition MVC" and "interval repetition MVC" in the static condition, but very significant

differences in dynamic condition ($p < 0.01$). Thus the dynamic training form of "continuous repetition MVC" is preferable to that of "interval repetition MVC" in improving the start strength, and vice versa in improving the maximal strength and the explosive strength.

2) Despite of the difference of conditions tested, any individual's muscles were activated in similar orders corresponding to the forms of "continuous repetition MVC" and "interval repetition MVC", but even in same form of action a significant person-to-person difference was found in the muscular patterns.

3) Comparing "continuous repetition MVC" with "interval repetition MVC", there was no significant difference in the myoelectric activity level of the muscles on a whole in static condition, but a significant difference in dynamic condition ($p < 0.05$). The myoelectric activity level of the muscles during "interval repetition MVC" was far lower than that during "continuous repetition MVC".

4) On both forms of "continuous repetition MVC" and "interval repetition MVC", the correlation degree of EMG-force is almost medium to low. Considering all the factors that may disturb the myoelectric changes, it is not adoptable and also not scientific that the muscular force was statistically predicted from EMG parameters at present.