

O52: Changes Of Profiles In Force, Power And Work During Counter-Movement Jump And Squat Jump

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There have been many studies investigating the relationship between the amount of force generated by lower limbs and jumping capability. It is a fact that a jumping height decreases as a function of age. However, it is also reported that it is not a force per se but a power that declines over age among fit elderly population. In this preliminary study, we closely examined the profile of force, power and work during two different forms of jumping in order to get insight into the utilization of force and power in physical performance.

In this study, six healthy university students (3 men and 3 women; age: 20.8 ± 0.4 y.o., height: 166.2 ± 8.4 cm, weight: 67.7 ± 14.2 kg) volunteered to participate. None of the participants had any neurological and orthopaedic disorder in the lower extremities within the last 5 years. All subject were informed about the purpose and the experimental procedures and gave consent to participate.

The subjects performed the counter-movement jump (CMJ) and the squat jump (SJ) on a Leonardo force platform system (Novotec Medical, Germany). During the trials, we collected the vertical component of the ground reaction force. The velocity and height of the center of mass (COM) as well as power and work were derived from a time series of the ground reaction force.

There were no significant differences in peak power across subjects within each jumping condition. However, in CMJ, a force showed different profiles corresponding to the degree of involvement in daily exercise among subjects. Those who exercise regularly showed two peaks of force before take-off; one at the moment when the COM reached at the lowest position (T1) and the other at the moment right before take-off (T2), while the others showed only one peak at T2. The existence of the force peak at T1 was reflected by a bulge observed at the early period of the concentric phase of power profile. This extra bulge in the power profile seemed to contribute to the larger amount of positive work in the exercise group. The extra bulge in power was not observed during SJ across subjects at all.

It has been reported that in CMJ a stiffness of lower limb is utilized as a mechanism of storing energy via stretch-shorten cycle. The detailed examination of force profile in CMJ indicates that the utilization of the energy storing mechanism may be an acquired behavior and the degree of utilization would vary through physical training. This further indicates in the field of physical therapy that we may be able to improve the performance of elderly population, not only by increasing the strength of muscles, but also by teaching the efficient utilization of what they already have.