MAXIMAL THEORETICAL STRENGTH: METHODOLOGY AND APPLICATIONS

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INTRODUCTION: We describe a new experimental method useful in the evaluation of strength, strength training and rehabilitation, and training control.
METHODS: The Maximal Theoretical Strength (Forza Massima Teorica - FMAXT) method has been developed from the equation F=P(1+a/g), which relates lifted weight (P) to muscular strength (F) expressed in lifting and to its acceleration (a). The test is carried out with a bench press and a multi-power machine (for testing upper and lower limb strength), both equipped with a photocell-system chronometer and linked to a PC that elaborates the data. The test consists of five consecutive lifts from a motionless start, each performed with increasing weight (P): we obtain, from the acceleration (a) expressed in the lifts (derived from the time measured by the photocells) the corresponding strength (F). The F obtained in the previous lift is used as the weight in the next lift.
RESULTS: 1) Reporting the five pairs (P-F) on a Cartesian plane, the points line up on an interpolating straight line (r=0.996) that, when intersecting the bisecting line of the plane itself, determines a condition (F=P) experimentally impossible to reach, because a=0. Such a value (FMAXT value) can be calculated only theoretically; it can be regarded as an 'absolute' strength value and is quantifiable as the average maximum isometric strength expressed in the totality of the movement. On the strength/velocity Hill's curve, the FMAXT value is located at the intersection of the curve with the axis of strength, in correspondence to v=0. (this study phase was carried out with 255 subjects for the upper limbs and 144 for the lower limbs) 2) When the single test is carried out with a double lift, the first starting from a motionless position (evaluation of the unique Contractile Component-expressed strength), followed, without pause, by a second beginning at the superior dead point reached in the first lift and divided into two phases, the falling phase (concentric phase with elastic energy accumulation in muscular Serial Elastic Component) and the second lifting phase (which expresses the strength derived from CC plus the CES-accumulated one), the FMAXT findings of the two lifts (motionless and with counter-movement) coincide (this second study phase was carried out with 120 subjects).
From the analysis of the FMAXT test results, some very significant data for personalized training programming can be obtained. These data are the maxFMAXT itself, the Maximal Concentric Power Peak, the Maximal Eccentric/Concentric Power Peak, and the Maximal Elastic Energy Percentage Reutilization Peak. Each peak can be characterized by an absolute value and by a relative percentage FMAXT-related value. In training control, comparing the results of subsequent FMAXT tests, it is possible to evaluate whether the programmed training has or has not produced the postulated adaptive phenomena regarding the contractile and/or elastic component of muscular strength.