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VASTUS LATERALIS METABOLIC RESPONSE TO EXPLOSIVE MAXIMAL ISOMETRIC LEG PRESS EXERCISE

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1. INTRODUCTION

Explosive force production is considered as an additional class of strength tests.[1] An important rationale for testing explosive force production has been the short time available for production in various athletic and other activities. The most applied test is the rate of force development (RFD) during which the subject exerts his maximal force in an explosive way. RFD can be assessed as the maximal slope of the recorded force-time curve or as the slope after a fixed time following the initiation of the contraction.[2] Leg press is one of the common core exercises that are utilized by athletes to enhance performance in sport. In particular, leg press exercise develops the upper leg, because it works the quadriceps, the hamstrings and the gluteus maximum. This exercise is normally performed on a machine where the legs press against a weighted platform. Muscle bioenergetics during explosive muscle strength has not been clarified yet.[3]

Near infrared spectroscopy (NIRS) is becoming a widely used instrument for measuring tissue O_2 status.[4] In fact, NIRS is a non-invasive and relatively low cost optical technique that offers the advantage of being less restrictive (no limitations on the type of exercise to be performed), more comfortable and suitable than ^{31}P-MRS for monitoring (with high temporal resolution, up to 100 Hz) oxygenation (then indirectly oxidative metabolism) of multiple muscle groups.[5]

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This study aimed at measuring *vastus lateralis* (VL) muscle O_2 saturation (SmO_2) response to a single very short-duration static (maximal voluntary force, MVF) leg press exercise.

2. METHODS

Seven male volunteers (23±2 years; 79±9 kg) were recruited for the experiments. The experimental procedures were explained, and all the subjects gave their informed consent. The subjects were physically active (although none were engaged in daily, intensive or specific training programs) with no history of serious lower extremity (specifically ankle or knee joint) injury. Leg press strength was measured on a commercial leg press equipped with strain gauge to convert analog force signal, sampled at 100 Hz, to digital signal and stored on a PC. The subjects were positioned on the sledge of the leg press with the knee ankle adjusted at 110° (Fig. 1). The waist was fixed and the subjects were allowed to stabilize their upper body by holding on to handles attached to the leg press. The position of each subject was documented so that it was identical for the duration of the protocol. Testing was only performed on the dominant leg.

Figure 1. Experimental setup.

A warm-up period of 10 min on a treadmill preceded the testing session itself. Each subject (accustomed to the testing procedure) performed five static leg press exercises with his maximal voluntary effort. For each trial, subjects were thoroughly instructed to act "as forcefully and as fast as possible". Interval between the bouts was about 15 min. During later offline analysis the trial with the maximum static leg press strength was selected. The following force parameters were considered: maximum isometric force output, duration of leg press exercise, and RFD. RFD was calculated using the maximal slope of the force time curve ($\Delta force/\Delta time$). Normalized force output values were determined as force relative to maximum force (expressed as % of MVF). The reported data are referred to the bout associated with the best developed force.