

TETANIC TENSION AND MUSCLE LENGTH OF MOTOR UNITS IN CAT'S PERONEUS LONGUS

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INTRODUCTION

Muscle tension is related to muscle length as demonstrated by studies on the whole muscle (8) and on isolated muscle fibers (5). It is conceivable that the same ratio may also be applied to single motor units; however, only few, old and contradictory reports (1, 6, 7, 12) are available on the performance of single motor units at different muscle lengths. Usually the length at which the whole muscle develops its maximal twitch tension is considered coincident to the optimal length of the different motor units. We reinvestigated the topic and a first group of results was presented (4). In this paper we showed that length-tension curves obtained by applying single shocks to single motor units are shifted to longer muscle lengths compared to the whole muscle contraction. In the present paper active length-tension curves were built by using tetanic stimulations and the results are compared with the precedent ones.

METHODS

Experiments were carried out on 7 adult male cats, weighing 1.5-3 Kg. The animals were anesthetized with Nembutal in peritoneum initially (40 mg/Kg) and supplemental doses were provided i.v. when necessary. Blood pressure was monitored and body temperature was maintained at 38°C. The peroneus longus (PL) muscle was exposed and its length was measured at different functional articular angles. Then the ankle was blocked in order to avoid movements during motor unit contractions.

The hindlimb muscles were denervated, sparing the PL muscle whose nerve was isolated by microdissection, the tendon was cut and attached to isometric tension transducer (GRASS FT-03). The muscle and nerve were kept in a pool filled with paraffin oil maintained at 37°C temperature.

After laminectomy the lumbosacral cord was exposed and the dorsal and ventral roots were cut and protected in a pool of paraffin oil. L₇ ventral root was mounted on Ag-AgCl₂ electrode which was used as anode, the cathode being the body animal. An active length-tension curve was constructed by stimulating L₇ ventral root and it has been judged a complete survey of PL motor units considering the large number of alpha axons innervating PL contained in this root. The stimulation was performed by using single pulses, duration 0.05 ms, intensity 1.5 times the voltage necessary to induce the maximal contraction, at muscle lengths ranging between the minimum and maximum (steps ranged from 0.5 to 1 mm) ankle angles. For each length three twitch responses, separated by intervals of 13 s, were recorded and averaged to measure the twitch tension. As described for

