Materials and Methods

Animals
Thirty-five male and female “peeler” crabs (within 2-3 days of molt) ranging from 70 to 85 mm premolt carapace width were obtained from O’Neals Sea Harvest, Wanchese, NC, USA. They were maintained in separate recirculating seawater aquaria at a temperature of 19°–23°C and a salinity of 32–35 ppt. Animals were checked every 2 hours for the onset of exuviation. Time postmolt was calculated from the time exuviation was complete. Individual crabs were measured at three different times postmolt (1 hour, 12 hours, and 7 days). Each animal was recorded for 5-10 min and was returned to its individual tank after the experiment. Only 16 out of 35 crabs molted successfully and were measured. Of these, only those that survived and appeared healthy after the first experiment were measured in subsequent trials (14 paper-shells and 5 hard-shells). Animals were not fed before experiments.

Pressure and force recordings
Individual crabs, at the postmolt stages described above, were placed in an experimental tank and restrained with Velcro straps on an aluminium slab to prevent movement. Crabs were positioned so that the left cheliped extended laterally and made a 90° angle at the merus-carpus joint. A force transducer (Fort 250, World Precision Instruments, Sarasota, FL, USA) was mounted level with the cheliped of the crab. A low-stretch Spectra cable connected the merus of the extended cheliped to the force transducer. The cable was kept taut to record the force of adduction without movement of the cheliped. A pressure transducer (BLPR, World Precision Instruments, Sarasota, FL, USA) was placed outside the tank at the level of the crab. A catheter of 50-gauge polyethylene tubing and a 23-gauge needle was inserted into the merus of the extended cheliped, into a hemocoelic space just beneath the arthrodial membrane near the merus-carpus joint. The catheter insertion was shallow to avoid entering the underlying muscle tissue.

Force and pressure transducers were connected to a preamplifier, which was connected to a computer via an A/D card. Calibrations of the force and pressure transducers were made before and after each series of experiments. Simultaneous recordings of force and pressure were made at a rate of 65 Hz by using data acquisition software (Dataq, Akron, Ohio, USA).

Data were analyzed with Dataq Software. Only clear muscle contraction forces were used for analysis. Instances when the catheter became blocked were not included in the analysis. A blocked catheter was easily recognized by the combination of absence of pressure fluctuation and the absence of increased pressure when the carapace of the animal was depressed manually. Clearing the catheter blockage was accomplished by withdrawing the needle and back-flushing the catheter.