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FREQUENCY DEPENDENT STIFFNESS OF THE UNSTRAINED RIGOR AND OF THE WEAKLY BOUND CROSS BRIDGE CLOSELY COINCIDES.

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Recently we proved that unloading of skeletal muscle in rigor results in a fall of frequency dependent stiffness. After unloading the fiber by a shortening length adjustment of 0.6 %, a remaining stiffness was observed, while the cross bridges stayed attached. To explore the nature of this stiffness we measured the in-phase and out-of-phase stiffness under three experimental conditions by releasing and stretching step changes in length of 0.025 %. From the induced tension transients the normalized (for length and diameter) stiffness was estimated from 10 Hz to 50 kHz. We compared rigor stiffness before and after unloading, at an ionic strength of 160 mM and at an ionic strength of 30 mM, and that of the relaxed fiber at an ionic strength of 30 mM. Despite differences in magnitude, in all cases the frequency dependent stiffness showed similar characteristics. The stiffness of the relaxed fiber at low ionic strength and the rigor stiffness after unloading at 30 mM closely coincided. No indication of attachment and/or detachment of cross bridges was observed in the spectrum of stiffness of the relaxed fiber (in agreement with Bagni et al, J.Electromyogr.Kinesiol.,1999). The present results indicate that the remainder of stiffness of the unloaded rigor is carried by unloaded cross bridges.