Structure and function of skeletal muscle in Zebrafish (*Danio Rerio*) larvae

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Zebrafish has become an important tool for examining development of organ systems, including muscle. Of great potential is the possibility to manipulate gene expression during early stages, and the availability of mutated strains. However, detailed information of muscle function is lacking. We have therefore examined Zebrafish muscle at an early developmental stage (larvae 5-7days). Using aluminum clips, preparations (~1.5mm length, 150µm diam.) were mounted for force registration. Electrical stimulation elicited very fast and reproducible single twitch contractions. Sarcomeres were oriented mainly in parallel with the preparation long axis and optimal length for active force was 2.17µm. Small angle X-ray diffraction showed clear equatorial 1.1/1.0 reflections, and showed that myofilaments are predominantly arranged along the preparation long axis. In contrast, reflections from adult fish showed two main filament orientations. Force summation was weak and a smooth tetanus was observed at a stimulation frequency of ~175 Hz. Single twitch/tetanus ratio was ~0.8. A fatigue stimulation protocol with repeated 200ms/175Hz tetani revealed that tetanic force decreased to 50% at a train rate of $0.1 s^{-1}$. In conclusion, Zebrafish larvae muscles can be examined *in vitro* using mechanical and X-ray methods and are longitudinally orientated with a significant fast contractile component.