A Model Based Analysis of Steady-State versus Dynamic Aspects of the Relationship between Calcium and Force

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INTRODUCTION
- The calcium-force relationship is dynamic (i.e., calcium-induced force generation is not instantaneous) during physiological contraction of cardiac muscle.
- Often, the calcium-force relationship is studied only under steady-state conditions.
- A mathematical model allows us to simultaneously study both dynamic and steady-state aspects of the calcium-force relationship.

BACKGROUND
Calcium is required for cardiac contractile activation and relaxation

Static vs. Dynamic calcium force relationship
- Myofilament response to calcium is often studied in skinned fibers
- Data produced using this technique is presented as force-pCa curves
- Exist characteristics of the calcium-force relationship that may not be described well by a typical force-pCa curve

METHODS
- Model-based Techniques
  - A mathematical model was used to predict calcium force pairs for a given calcium input.
  - Applied time-varying calcium and constant calcium inputs in order to observe dynamic and steady state responses.

RESULTS
- Systematic Varying of Parameters
  - Made simultaneous adjustments of baseline parameters from ~50% to 50% and analyzed indices describing steady-state and dynamic waveform characteristics

REFERENCES