



Priority Statement Title: Establishing Standards for Vivo Quantification Joint Dynamics

Priority Statement Code: CJ4C

Domain: Cell - Joint-Whole Body

Priority Statement

Background and Relevance

The rising cost of musculoskeletal pathologies, disease, and injury creates a pressing need for accurate and reliable methods to quantify 3D dynamic musculoskeletal function. Recent advances in medical imaging have provided a wide ranging set of tools (MRI, fluoroscopy, motion analysis, ultrasound, and CT) that provide insights into specific aspects of joint dynamics. Each method has its associated strengths and weaknesses. With this rapid introduction of tools for the 3D *in vivo* quantification of dynamic musculoskeletal joint function there is a pressing need to standardize definitions and validation criteria.

A major barrier in this field is that currently, individual investigators are championing their own tools in isolation and there is minimal cross pollination between various techniques. Thus, a critical advancement is to establish standards allowing these techniques to be used in combination in order to provide a more complete picture of 3D dynamic musculoskeletal function.

Objectives

1. Standardize the validation of techniques for the quantification of *in vivo* 3D dynamic musculoskeletal function.
2. Define the current state of the art in order to establish clear guidelines in regards to the capabilities and limitations of each technique that can determine *in vivo* 3D dynamic musculoskeletal function.
3. Foster the advancement of these techniques for translational clinical research.
4. Enable comparison and collaboration across labs with an end-goal of supporting multi-center studies based in these techniques.

Recommendations

1. Develop a standards committee that will create:
 - a. Clear definitions of and standards for reporting accuracy, precision and subject repeatability; along with justifications for these requirements
 - b. Set the envelope of accuracies, resolutions (temporal and spatial) required for specific applications
 - c. Create a checklist of assumptions used, accuracies achieved and limitations capabilities for easier comparison across techniques.
 - d. A mechanism for documenting dissent.
 - e. A mechanism for ongoing development.
 - f. Multiple mechanisms for dissemination and refinement standards (internet, conference).
2. Establish a group of thought-leaders to write a review paper on the state of the art for the *in vivo* measurement of 3D dynamic musculoskeletal function, with a particular focus on elucidating the envelope of applicability of each technique.
3. Establish reference databases (possibly at NLM) of varied motions and joints for inter-laboratory comparisons of techniques/results (analogous to GEO profiles at the National libraries of Medicine).

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