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Our group has been able to identify that there are key issues that relate to 1) how we consider the musculoskeletal/musculotendinous structures of the body and 2) our ability to openly share data. These two issues affect our ability to describe 'normal' and 'pathological' biomechanics accurately.

Over the past decade there have been significant advances in technologies such as optical motion capture, which now allow for more detailed marker sets, which to a large extent rely on modeling conventions over 20 years old. These have an impact on our description of pathology as these assumptions are integrated into the models that we use. Through imaging studies we know that geometry is variable across an apparently normal sample, so to consider geometry to be consistent in a pathology that directly affects the joint surface is a huge misjudgment. In addition to geometric consideration we also must consider the musculotendinous structures in more detail. Currently we assume that fairly simple scaling parameters can be applied to generic models in order to scale to the anthropometry of an individual, again this may result in inappropriate descriptions of 'normal' and pathological'. In all these factors will help in the development of subject / patient / task specific models. These models must have the flexibility to be tailored to the need quickly and easily, compiling the information from multiple sources. Enhanced modeling protocol will allow for better classification of 'normal' and 'pathological' biomechanics. In addition to the development of enhanced modeling protocol, we need to consider our reference standards for pathological biomechanics; i.e. to normal and sub groups of the same pathology. This will require an agreement for the pooling of data of multiple types, in a similar way to the BMC series of journals allows the scientific community free access to online journals, we should look to develop a free online resource of biomechanical data.

Recommendations:

1) Anatomically accurate models. We should look to develop protocol to develop anatomically accurate models that can be used to better estimate joint function and provide a more detailed description to guide clinical decision making. We should look to better integrate imaging techniques rapidly into our models.

2) Scalable musculotendinous models. Muscle function estimation based on kinematic input variables may help to further explain clinical findings and guide intervention planning. These models must be accurate, reliable and truly scalable.

3) Database of perceived normal and pathological functional biomechanics. We need to be able to describe function in comparison to the presumed healthy, the diagnosed healthy and within pathology during different functional tasks. We must establish a widely accessible database of functional tasks and the adaptations found in different groups. This should follow the biomed central model allowing open access to data that has been previously published, which demonstrates its reliability and validity. The database should be an evolving entity that retains the original information, whilst combining data from sources around the world. It is important that standardized protocol be developed for functional tasks.