Joint Dynamics Pty Ltd

A New Tool/Service to Introduce Accuracy and Objectivity to Physical Assessments for Enhanced, Cost-Effective, Accountable & Fairer Treatment Outcomes

A New Tool to Ensure More Accurate and Factual Joint Function Assessments

A New Tool/Service to Enhance Accuracy and Objectivity

in Musculoskeletal Joint Function Assessments

COMPARISON OF PRESENT METHODS

with the

NEW JOINT DYNAMIC'S APPROACH

to

ACCURATE COMPREHENSIVE & FAIRER

JOINT FUNCTION ASSESSMENT

COMPARISON OF POPULAR PRESENT & NEW METHODS

Introduction

To assess the functional impairment or capability of a person is a difficult task because the impairment or capability provided is a function of what the subject is prepared to provide. There may be many reasons that a subject provides a less than maximal effort and this is the reason that presently used methods to measure the set of factual functional abilities is prone to substantial errors.

The second cause of substantial errors in assessing impairment or capability is the fact that many devices to measure angles are handheld and for inter and intra-tester to be close to accurate high levels of skill in the alignment and positioning of goniometers and inclinometers. There are many documents confirming the inaccuracies and shortcomings – for example to have measurements of the range of movement stated as 90 degrees with a standard deviation (SD) of say 6 degrees (well documented) means that there is a 95% chance that the factual range of movement lies somewhere between 72 degrees and 108 degrees!

If it was known that maximal efforts could be identified and the measurements of the key parameters were independently verified as accurate, it would be a case of "*Is it better to measure a functional parameter or estimate it in some way*? Is the best evidence being used to make effective and accurate evidence based decisions?

What are the key aspects of the presently used decision foundation data when used in physical joint function assessments?

This document has been compiled to comprehensively compare old and new foundation data commonly adopted by medical professionals to form the basis of a functional assessment the of a joint or series of joints.

The key aspects causing inaccurate and unfair outcomes are:

- Inaccurate measurements from handheld devices with no defined accuracy or confidence level provided.
- Not knowing whether a force or torque measurement was the result of a maximal or sub-maximal effort.
- Functional Capacity Assessments stating functional performance to be "objective" when no measurements are made.
- Referencing the AMA Guides as being the best method of quantifying joint function in musculoskeletal & soft tissue injuries when no measurement of torque (strength) in included.in functional assessments.
- Excessive reliance on information provided by the subject – some even suggesting that survey information is objective and quantitative.
- The perception that a visual estimation has high accuracy comparable to a machine.
- The inability to detect small changes in rehabilitation/treatment progress – saves costs.
- Lack of objective knowledge of the status of the rehabilitation to make quality decisions by all involved including the Case Manager.
- Non- scientific method of timely and accurate identification of attaining the Maximum Medical Improvement Milestone (MMI).
- Return to Work (RTW) Capability Assessments includes virtually no quantitative measurements.
- No structured scientifically measured dynamic functional assessments are carried out.

There are very few studies of the degree of accuracy found in physical assessments of injured patients by medical professionals. This could be readily achieved by having 10 professionals independently assess the same subject and statistically evaluate the consistency of each of the assessments.

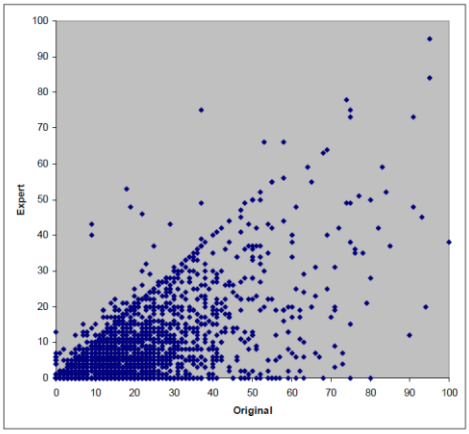
In a comprehensive US trials of the accuracy of present impairment assessment methods based on the American Medical Associations Guides to Impairment have shown that over 80% are incorrect.

"AMA Guides Sixth Edition: Perceptions, Myths, and Insights"
By Christopher R. Brigham, MDi, W. Frederick Uehlein. JDii, Craig Uejo, MD, MPHiii and Leslie Dilbeck, CIRiv

Christopher R. Brigham, MD, is President of Brigham and Associates, Inc. (www.impairment.com) and Senior Contributing Editor of the AMA Guides Sixth Edition, and Editor of the Guides Newsletter and Guides Casebook. Dr. Brigham is an internationally recognized expert on the Guides, author of nearly 200 articles on impairment and disability assessment, and an accomplished consultant and professional speaker.

*"For a two-year interval, from June 2006 through June 2008, experts in impairment assessment associated with Brigham and Associates, Inc. reviewed **2798** impairment rating reports authored by other physicians and chiropractors. The experts disagreed with 2169 of the ratings (78%) and of these reports that were judged to be incorrect the average original rating was 20.4% whole person permanent impairment and the average re-rating by the expert was 7.3% whole person permanent impairment. (A comparison of original ratings versus re-ratings by experts is illustrated in Figure 2.) The error rate does vary be jurisdiction, for example in California, 84% of the reports were found to be incorrect with an average original rating of 20.8% versus expert rating of 7.0%; however, in Hawaii the error rate was less at 39% with an average original rating of 9.0% versus expert rating of 3.8%. The differences between these two states are illustrated in Figures 3 and 4."*

Figure 3. Comparison of Original Rating vs. Expert Ratings in California



The full document is available on the web.

What level of confidence can be had for the very critical impairment assessment or RTW assessment that has differences compared to the expert assessment (20.8% minus 7.0%)? This means an average error of 13.8% in whole of person impairment calculations.

The problem of having an impairment average error of 13.8% is that it is believed to have a maximum error of 1%. For example, the percentage impairment could be expressed as 12% ± 13.8%. This results in an assessed impairment with a 95% confidence level - the impairment could be anywhere between 0% and 25.8% impairment!!!!!!!!!

This comparison simply validates that present methods used to calculate impairment are not accurate. There are other similar studies which also confirm erroneous results when an impairment assessment is carried out.

It is difficult to understand impairment assessment results which can have an error of 13.8% when referenced to a whole of person impairment threshold of 11%.

Description of Feature	Now	New
Angles		
Angles read off a scale by assessor (eg Universal Goniometer)	✓	✘
Accurate standardised repeatable method	✘	✓
Accuracy is not highly reliant on the skill, technique or experience of the person making the angular measurement	✘	✓
Are joint misalignment errors eliminated?	✘	✓
Can be accurately measured under no-load conditions?	✘	✓
Can be accurately measured under variable load conditions?	✘	✓
Can be accurately measured under static conditions?	✘	✓
Can be accurately measured under dynamic conditions?	✘	✓
Can be accurately measured under variable speed conditions?	✘	✓
Are the confidence levels in the measurement high & repeatable?	✘	✓
Are Intra-tester errors unlikely?	✘	✓
Are Inter-tester errors unlikely?	✘	✓
Is the joint isolated during measurements?	✘	✓
Can the angular measurement accuracy be defined?	✘	✓
Is the measurement accuracy validated by a national body (NATA)?	✘	✓
Can accurate statistics be provided to confirm high data accuracy?	✘	✓
Can accurate graphical progress representations be provided?	✘	✓
Force/Torque - Unknown Effort Issue (UEI)		
Accurate standardised method (UEI)	✘	✓
Accurate measurements not highly reliant on experience of tester	✘	✓
Can it be accurately measured under static conditions (UEI)?	**Possibly**	✓
Can it be accurately measured under dynamic conditions (UEI)?	✘	✓
Can it be accurately measured under variable speed conditions (UEI)?	✘	✓
Are Intra-tester errors unlikely	✘	✓
Are Inter-tester errors unlikely	✘	✓
Is one part of the joint is isolated during testing	✘	✓
Can torque measurement accuracy be quoted (UEI)?	✘	✓
Is the accuracy validated by a National Testing Organisation?	✘	✓
Can accurate statistics be generated to confirm high data accuracy (UEI)?	✘	✓
Can useful torque data be collected without knowing the effort provided by the subject was maximal (UEI)?	✘	✓
Are accurate graphical progress representations possible (UEI)?	✘	✓
Effort		
Is the effort by the subject objectively measurement an accurate standardised method?	✘	✓
Is effort measured over the full range of active movement range?	✘	✓
Can individual measurement accuracy be scientifically quoted?	✘	✓
Can accurate statistics be generated based objective results?	✘	✓
Can graphical representations be provided over the full ROM?	✘	✓

Description of Feature	Now	New
Fatigue		
Is this measured by an accurate standardised method?	✘	✓
Is this normally included in assessment foundation data?	✘	✓
Can it be measured under variable speed conditions?	✘	✓
Can it be reliably identified as Maximal or Sub-maximal?	✘	✓
Can measurement accuracy be quoted?	✘	✓
Can accurate statistics be generated?	✘	✓
Can accurate graphical status representations be provided?	✘	✓
Accountability		
Accountability & auditing can only be possible if objective facts are known.	✘	✓
Case Management to accurately manage costings based on facts	✘	✓
Normative Data Comparison Possible		
Is an accurate standardised method used for normative data comparison?	✘	✓
Is this comparison normally used in a function assessment?	✘	✓
Can be compared under variable speed conditions?	✘	✓
Can strength data be reliably identified as Maximal or Sub-maximal?	✘	✓
Can measurement accuracy be quoted or compared?	✘	✓
Can accurate graphical representations be provided?	✘	✓
Miscellaneous		
Are accurate rehabilitation progress graphs and results available to provide meaningful transparent feedback to the person being assessed?	✘	✓

Problems with Old Methods

1. Subjective assessments are based on non-objective & non-evidence-based data
2. To assess joint function, usually only one parameter is “measured” eg static Range of Movement - any other parameters such as strength (torque) under static or dynamic conditions are usually ignored due to the lack of ability to get meaningful results.
3. No methods in place to fully and accurately assess the factual function of a joint or series of joints.
4. Due to the high level of interpreted subjective information it is virtually impossible to audit the conclusions in a Musculoskeletal Function Assessment
5. Little or no standardised structure required for assessment and treatment regimes – does not ensure completeness of the medical process.
6. Goniometers have well documented large alignment, inter- and intra-tester errors.
7. Angles and force measurements are not measured under dynamic functional conditions.
8. Whole Person Impairment (WPI) based on angles without attempting to measure the important available Torque/Force that the joint can impart – this immediately ensures only an incomplete functional assessment (approximately 50%) is possible.
9. Work Capacity Assessments in most cases are carried out subjectively by non-medical professionals such as a physiotherapist (eg then a case manager with virtually no foundation of objective joint function assessment data provided to them has to make critical and possibly life-changing decisions).
10. Excessive reliance on subjective information gained by asking the subject a series of questions.
11. Angular measurements with goniometers do not have NATA accuracy validation because it is a manually aligned device.
12. Joints are not isolated when measuring takes place – creates large errors.
13. No meaningful force or fatigue measurements able to be captured because it is not known that the maximal effort was provided by the subject – this is a major problem.

14. Professionals cannot have high confidence levels when an assessment/report has such a large amount of subjective information as a foundation – results in over servicing.
15. Accuracy of angular and torque (force) measurements is unable to be quoted ie the gradation increment of a goniometer measurement is not the accuracy of the user operated goniometer by itself.
16. No useful normative data is available for comparison because it is not known how accurate the device is or whether the torque values provided by the subject are maximal.
17. Difficult to provide graphical representation of the progress of the rehabilitation – especially in the case of providing meaningful factual feedback to the person.
18. Accurate Statistics or graphs cannot be developed because of inaccuracies and not knowing that a maximal effort was provided at the time of testing.
19. Fatigue is a key parameter that is not measured in a standardised manner – this is a critical parameter in the function use of a joint.
20. Muscle atrophy is rarely measured in a standardised accurate manner.
21. Medicolegal arguments based on a highly subjective foundation, ensures excessive argument times and less chance for a court to make an ultimate accurate and fair decision.
22. There is a high risk that the ultimate analysis built on the subjective evidence, will provide errors in determining the prognosis; identifying the Maximum Medical Improvement milestone; assessing WPI impairment; the Work Capacity and the outcome fairness to the innocent worker.

What does the Joint Dynamics Joint Function Assessment System do to address the weaknesses found in present methods & tools?

1. Independent objective Joint Function Assessment - not biased towards any party.
2. Provides comprehensive transparent and meaningful measured functional data including dynamic ROM; Static & Dynamic Torque; Fatigue data with progress curves of each measured parameter.
3. Provides a standardised method to measure angles, force/torque and fatigue.
4. Use objective accurate measurements of joint function to have an accurate foundation upon which enhanced subjective interpretations can be more accurately made.
5. Highly standardised structure of assessment and treatment methods for each type using standardised computer questionnaires detailed treatment paths ensure completeness and the highest efficiencies of the medical processes
6. There is no room for the assessor to introduce technique errors – thus eliminating inter and intra-tester errors.
7. The endpoints of movement angles and force/torque are captured under static and dynamic real world movement conditions.
8. The Joint Dynamics system has NATA (Australia's National Testing Body) approved accuracy validation for measured angles and torque.
9. Joints are isolated to ensure tests can be accurately compared with data gathered from other testing facilities.
10. Reduced reliance on possibly incorrect data sourced from the subject due to it being replaced with high quantity objective measured parameters.
11. The effort is measured to ensure that force/torque data is meaningful- without knowing the effort provided by the subject measured force/torque data has little to no scientific value.
12. The operator of the assessment system cannot substantially influence the accuracy therefore an accuracy of the measured parameter can be statistically quoted.
13. Any normative data collected by the Joint Dynamics Joint Assessment is meaningful because it can be confirmed that it was acquired under maximal effort conditions.
14. Due to the validated accuracy and standardised assessments, accurate and meaningful progress reports can be provided to the person and shared by rehabilitation professionals – a totally transparent system.
15. All force/torque data is associated with a provided effort and as a result, meaningful accurate statistics can be acquired.

16. The Joint Dynamics System collects fatigue data because this parameter is very important to a comprehensive accurate and meaningful functional assessment.
17. Muscle atrophy is measured and identified as part of the comprehensive joint function assessment.
18. By ensuring objective measured base data is acquired in a joint functional assessment, the quality & accuracy of WPI and Work Capacity Assessments will be maximised.
19. The result of minimal or zero quantitative assessment foundation data, ensures the lowest decision making confidence levels in providing quality and the fairest conclusions.
20. Quantitative objective unbiased measured data as a solid foundation, ensures the highest quality and fairest legal outcomes.
21. Ensuring the risk of evidence errors are minimised by using measured facts for a foundation of decisions instead of subjective estimations.

Notes:

- Multiple articles and papers can be provided to verify the poor accuracy of angles acquired by a person using a handheld universal goniometer or inclinometer to measure joint movement end-points.
- Unless normative data is collected knowing that a maximal effort was provided by the person being tested, any presently available normative data has little or no validity at all and should not be used.
- Unless any measured parameter is collected by an accurate standardised scientific method there can be no comparative assessments made.
- For a system to quote a quantitative objective value it is important that the parameter being measured on the system must have a NATA (Australia) independently verified accuracy.
- A force/torque measurement has virtually no validity unless the effort is known to be maximal at the time of measurement.
- The scope of the acquired data using the new technology is comprehensive and will be able to be validated in numerous subsequent clinical trials.
- Progress data and graphical representations of the factual status of the rehabilitation provides many feedback benefits to all people involved especially to the person being tested.
- If a person is tested in Sydney and moves to Wollongong, all collected objective data will be standardised, centralised and accessible by all authorised parties including the subject.

Four Simple Very Basic Measurement Questions that should be Addressed:

- Is a higher quality musculoskeletal or soft tissue injury outcome more likely to be achieved with quantitative, objective & accurate measurements of functional parameters **OR** by using someone's perception of the magnitude of that parameter?
- Is it important that a measured force or torque measurement be known to be provided under maximal effort conditions?
- Is physical assessment accuracy perceived by the medical and medicolegal world, to be critical to achieving high quality, accurate and the fairest outcomes?
- If all issues hinge on the status and functional performance of a joint, does the rehabilitation industry have a duty to use the best available objective evidence-based methods in practice?

Making Decisions Based on Various Qualities of Available Evidence
From Wikipedia, the free encyclopedia

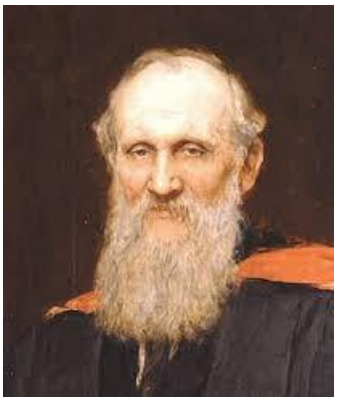
"Evidence-based medicine (EBM) (sometimes called evidence-based health care or EBHC to broaden its application to allied health care professionals) has been defined as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[1][2] Trisha Greenhalgh and Anna Donald define it more specifically as "the use of mathematical estimates of the risk of benefit and harm, derived from high-quality research on population samples, to inform clinical decision-making in the diagnosis, investigation or management of individual patients."[3]"

Is quality evidence-based healthcare occurring when a patient's temperature is assessed by a Professional placing their hand on the brow of the subject and providing a subjective interpretation of the temperature **OR** by using a digital thermometer which has an accuracy of 0.1 degrees Centigrade? Think of the case where the professional has a slight fever and senses no temperature differential with the patient.

In the majority of cases, "evidence-based" decisions never have the quality of the "evidence" accuracy defined to be of "high or "poor" quality. Many assume that because it is some type of "evidence" to support a decision it is good quality evidence. There is no structure or mechanism to question or confirm the value of foundation "evidence" upon which very critical decisions are based.

A simple comparison of evidence quality is demonstrated when ascertaining strength. One end of the evidence quality scale may be achieved by asking the subject the question "Is your strength getting better?" The other end of the quality scale by measuring the torque (not the strength) and stating that the torque has been accurately measured and it was found to be 16% improved over the last 4 weeks. The measured results were identified as being provided under Maximal Effort conditions.

Assessing Joint Functional Performance.



"When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts advanced to the stage of science."

Quote from the 1880's by William Thomson, 1st Barron Kelvin - a British mathematical physicist and engineer.

This saying was abbreviated by Peter Drucker to:

"If you can't measure it – you definitely can't manage it."

A Universal Goniometer in Use

This is a random image taken from the web explaining the use of a Goniometer

Note: The alignment error with the lower leg landmarks– an easily made common error with the frequently used handheld Universal Goniometer.

The above image shows approximately an 11-degree possible error in the alignment of the arm of the goniometer. This could result in an 8% error when measuring over the full ROM.

The use of Factual, Measured, Independently Verified Accurate, Unbiased and Objective Data as a robust foundation, is the only way to reduce assessment inaccuracy to ensure the highest levels of fairness to the injured person throughout the complete rehabilitation process and evaluations to return a worker to work.