THE ULTIMATE HOW-TO GUIDE FOR USING A

CRANE SCALE

YOUR BLUEPRINT FOR ACCURATELY MEASURING ISOMETRIC FORCE OUTPUT

SCIENCE for SPORT

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SCIENCE for SPORT
Elevating Performance

1) ABOUT THE CRANE SCALE

This simple device is extremely portable, very easy-to-use, and has been shown to have a near perfect correlation with a portable force plate (Kistler, Switzerland, Model 9286AA)during the Isometric Mid-Thigh Pull (IMTP) test [1]. If you need/want to know more about the IMTP test, then read our full article on **what it is, why it's useful, and how to conduct the IMTP here.**

The crane scale is capable of measuring force in the following metrics:

- Kilograms (kg)
- Pounds (lbs)
- Newtons (N)

Force plates are considered as the gold-standard for force testing but typically cost upwards of $10,000 (USD). Although force plates are often portable, they tend to be both big and heavy, thus making them very inconvenient to transport. In addition to this, they often come with software which isn't very user friendly and data heavy, making them a headache to use when trying to get simple data.

On the other hand, crane scales are almost small enough to fit in your pocket, cheap, very easy to use, and still has the ability to measure force with almost the same level of accuracy[1]. Having said that, they're definitely not perfect, but, then again, what is?

One of the issues with a crane scale is they can only compute force production, **not rate of force development,** time to peak force, etc. It also doesn't pause on 'peak force', meaning you have to video record it and use the scrubbing feature to analyse the peak force value (more on this later). Despite these minor problems, the benefits of the device far outweigh the issues.

2) WHAT CAN I USE THE CRANE SCALE FOR?

The crane scale can be used for many different purposes, the most popular of which are:

1. Measure an athlete's maximum force capacity (i.e. their strength).
2. Measure the effectiveness of training interventions.
3. Reduce injury risk (by increasing their relative strength capacity and understanding their "freshness/readiness to train").
4. Monitoring fatigue (understand the athlete's "freshness/readiness to train").
5. Comparing athletes' and creating competition.
6. Measuring between-limb asymmetries.

Measuring an athlete's strength

As the old saying from Peter Drucker goes, "what gets measured, gets improved." Measuring an athlete's strength (i.e. maximum force capacity) is, therefore, vital if you're serious about improving them as an athlete. As I'm sure you're already aware, power is a critical component to athlete success in so many sports [2], and the power equation goes like this:

Power (W) = force (N) * velocity (m/s)

In plain language, if you increase an athlete's strength (i.e. force) and maintain their velocity (i.e. speed of movement), then you'll increase their power output. As a result, you can clearly see how important it is for measuring and improving an athlete's strength (i.e. force production).

Measure the effectiveness of training interventions

This use is simple and ties in to the point above. If you can measure how strong an athlete is before you implement your training programme designed to improve their strength, then you'll be able to tell whether that intervention was actually successful or not.

Now, of course, you can measure an athlete's maximum strength (i.e. maximal force capacity) by using a **dynamic 1RM test,** but they are often time-consuming, tiring for the athlete to perform, they place the athlete at risk of injury, and strength fluctuates daily, so measuring an athlete's true maximum can be tricky. With the crane scale, on the other hand, these issues are eliminated.

2) WHAT CAN I USE THE CRANE SCALE FOR? (CONTINUED)

Reduce injury risk

This is a big one for any coach or practitioner who is in the business of reducing their athletes' risk of injury, so to speak. Quite simply, we know that stronger athletes get injured less [3]. This means that if you can quickly and easily assess an athlete's maximal strength (i.e. maximal force capacity), then you can ensure that you're making them stronger and therefore less prone to injury; simple.

Monitoring fatigue

Fatigue is typically referred to as a reduced capacity for maximal performance [4]. If you wish too, you can **read more about fatigue and how to monitor it here.** So, for that reason, it would seem that the best way to measure fatigue directly would be by using a maximal effort (i.e. maximal performance) test. And, as the theory goes, if an athlete is tired or fatigued, for example, their maximal physical output (e.g. IMTP test of countermovement jump) is likely to be reduced and thus demonstrate this fatigue.

Monitoring an athlete's fatigue and readiness-to-train can often be complicated and time-consuming. However, using the crane scale to measure peak force in the IMTP makes this much quicker and easier. Also, because the IMTP is an isometric exercise, the residual soreness and fatigue from using this test is minimal in comparison to a 1RM back squat, for example.

Measuring an athlete's maximal strength on any given day may help you to determine how "fresh" they are for training on that day. This will, in turn, help you make any adjustments to their training prescription (e.g. training intensity or volume).

2) WHAT CAN I USE THE CRANE SCALE FOR? (CONTINUED)

Comparing athletes and creating competition

By obtaining the relative strength (N/kg) of each athlete within a team, for example, you can compare each athlete against one another and even share the results with them all. This provides clarity as to who the strongest and weakest athletes are. Having things such as a leader board can work well for building athlete buy-in and generating inter-team competition.

It is, however, important to understand that an athlete's relative strength is just "one colour in a palette". For example, there are many other aspects of performance, such as rate of force development. So, just because one athlete is stronger than another, it does not mean they are a better athlete or are also more explosive than the other.

Measuring between-limb asymmetries

At present, it is becoming common within the world of high-performance sport to measure between-limb asymmetries by conducting the IMTP and analysing performance using dual force plates – **click here to see what dual force plates are.** However, this calibre of equipment can cost of thousands of dollars, not only as a once-off payment, but every year.

So, for the coach/practitioner working on a shoestring budget, this won't be an option.
If this is you, there may be hope for you yet, and we'll do our best to help you in every way possible. For example, it may well be possible to assess between-limb asymmetries with a crane scale simply by using a single-leg IMTP, though this has yet to be scientifically validated. Having said that, the single-leg IMTP has been shown to be reliable when measuring peak force [5].

As such, we see no reason for you not to try this and perform your own in-house research and data collection with the single-leg IMTP and the crane scale. Not sure where to begin with doing this? Simply replicate the procedures conducted **in this study** but with a single-leg IMTP. And, if you need to know more about the single-leg IMTP, then **check out this study.**

3) HOW TO USE THE CRANE SCALE

This device is extremely simple to use. Firstly, it's important to know that the crane scale has a maximum load capacity of 300 kilograms, 661 lbs, 2942 N. While this will be sufficient for most athletes, it won't be strong enough for everybody. For example, elite-level weightlifterswill likely be too strong for this device.

To begin, unbox the crane scale and insert 3 x AA batteries (not included). Follow the instructions to piece it together. Once you're done doing that, simply press the "ON/OFF" button to switch it on. Once it's switched on, press the "UNIT" button and select the units you wish to measure in – we recommend you use 'kg' as the performance recording sheet provided is pre-set to kg. Once that's done, you're ready to begin testing.

IMPORTANT: you'll need to use a smartphone with video scrubbing (e.g. iPhone) in order to determine the peak force value as the device will, unfortunately, not freeze and hold this value. When the athlete is ready and you're ready with the camera, simply start recording and instruct the athlete to perform the test.

4) HOW TO PERFORM THE TEST

Step 1: setup all of the equipment

Step 2: weigh the athlete (record in kg)

Step 3: conduct the test using the information below

The IMTP requires individuals to pull on the bar with maximum effort for a continuous 3-5 seconds for a total of 3-5 times (i.e. trials). We recommend you perform 5 trials of 5-second repetitions with 1-minute of rest between each trial. Administration of the IMTP test requires a standardised protocol to get the most reliable data.

Equipment required

• Crane scale (300 kg load capacity)
• Stable surface (e.g. a weight plate will work – a cast iron plate is best)
• High-capacity, heavy-duty ratchet straps (300 kg load capacity)
• High-Strength Carabiner (300 kg load capacity)
• **Lifting straps**** (essential)
• Video camera with scrubbing ability (e.g. iPhone)
• Performance recording sheet (you can download one here)

**Lifting straps MUST be used to ensure that grip strength is not a limiting factor [6].

4) HOW TO PERFORM THE TEST (CONTINUED)

The Setup

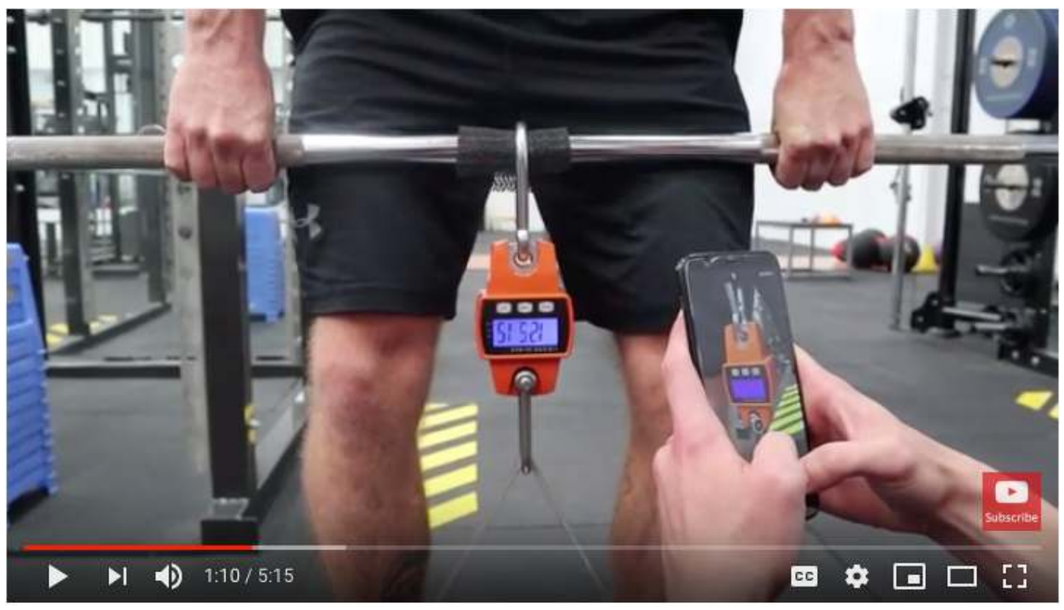
The individual being tested should be sufficiently warmed up and be familiarised with the protocol. Body positioning is critical during the IMTP and can affect the outcome/data produced. Dos'Santos et al. [5] reported that hip angle significantly affects peak force and RFD, with a hip angle of 145° recommended as optimal. Two practice trials of the IMTP before recording will help prevent intra-individual errors.

The barbell must be placed at the height of an individual's mid-thighs when they are in a slight RDL position. Secondly, the athletes should be educated on your cues as well as the signal for when to start the pull. Cueing is important and can help produce the best results from your athletes. Test administrator cues should be concise, sharp, and consistent whilst avoiding over-explanation. Here's an example of the cues I give when administering the test:

- Step onto the plate with thighs touching the bar.
- Wrap your hands around the bar without pulling.
- Shoulders back. Chest up. Look straight ahead.
- 3, 2, 1, PULL!

Both testers and athletes should practice (i.e. familiarise) the testing protocol multiple times before implementing the test to collect real data to ensure they are completely familiar with the process.

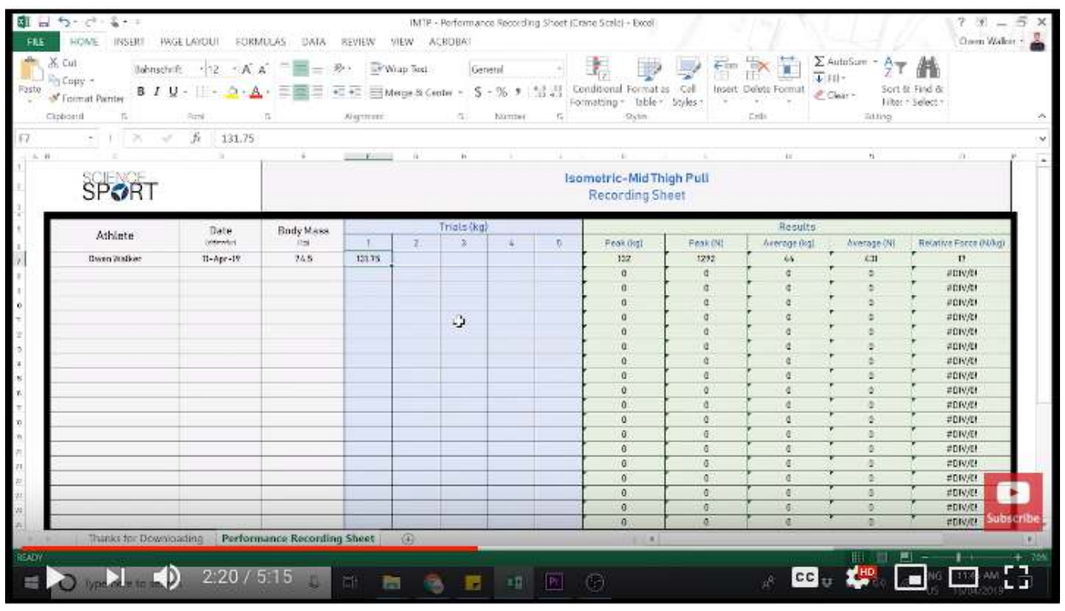
As it's often easiest to understand what to do by watching a video, we filmed the testing procedure for you to make your life easier. So, watch the video below to see the IMTP using the cranes scale in action.



5) HOW TO RECORD YOUR DATA

Remember, you must record the crane scale screen during the test so that you can analyse the performance data afterwards. Once you've completed the test and filmed the screen. You then need to scrub through the video and find the peak force value. Once you've found that value, simply enter the data into the performance recording spreadsheet **(download it here)** and it'll do the rest for you.

Watch the video below to see the data analysis in action.



6) NORMATIVE DATA

Here is some normative data collected from multiple sources to help you understand the performance of your athletes.

Gender	Cohort	Ref.	Peak force (N)	Peak force (kg)	Relative force (N/kg)
Male and female	Recreationally active males	[7]	1891	193	25.0
Male	Recreationally active males	[8]	1854	189	23.6
Male	Collegiate soccer players	[9]	2067	211	30.8
Male	University students	[1]	2025	206	23.8
Male	University rugby union players	[10]	2945	300	34.0
Male	Professional rugby league players	[5]	3238	330	33.8
Male	Collegiate athletes	[5]	3180	324	40.6
Male	Recreational weightlifters (experienced)	[11]	4587	468	54.3
Male	Recreational weightlifters (inexperienced)	[11]	3494	356	46.5

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