Keele UNIVERSITY
Impact Accelerator Unit

Clinical Question

Are hand-held dynamometers (HHDs) a valid and reliable tool for measuring muscle strength in musculoskeletal (MSK) clinical settings?

Hand-held dynamometers are a valid and reliable tool for measuring muscle strength in MSK clinical setting, especially in young or athletic populations. While testing protocols and variability between testers should be considered, HHDs offer significant benefits in clinical practice, especially when integrated into individualised exercise prescriptions and rehabilitation plans

Clinical bottom line

Hand-held dynamometers (HHDs) are a **valid and reliable** tool for measuring muscle strength in **musculoskeletal clinical settings**, particularly in athletic populations. While **variability in tester reliability** and overestimation of muscle strength compared to isokinetic dynamometers may occur, these issues are largely influenced by **testing protocols** rather than the tool itself. HHDs are especially useful for tailoring **exercise prescriptions** and improving **patient adherence** to rehabilitation programs. However, **more standardised testing procedures** and comparisons with manual muscle testing are needed to confirm their role in clinical practice and assess their impact on patient outcomes.

Plain Language Summary

Hand-held dynamometers (HHDs) are tools that can measure how strong your muscles are. They work well for people with muscle or joint problems, especially athletic populations. HHDs are easy to use, don't cost too much, and help physiotherapists create **better treatment plans** to make people stronger. Sometimes, the results can change depending on who's using the tool, and it might say someone's muscles are stronger than they really are compared to more expensive machines. But even with those little problems, HHDs are still

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helpful because they can help patients stick to their exercise plans and get better. Just remember, HHDs might not be as accurate with really strong or athletic people.

Why is this important?

Accurate and reliable measurement of muscle strength is critical for assessing patients' functional abilities, guiding rehabilitation, and tracking progress in musculoskeletal conditions. Hand-held dynamometers (HHDs) offer a **cost-effective, portable, and easy-to-use alternative** to more expensive or complex tools like isokinetic dynamometers. Their ability to measure muscle strength reliably in clinical settings, especially in older or non-athletic populations, helps clinicians tailor **individualised treatment plans** that target specific weaknesses and improve **patient outcomes**. Furthermore, using HHDs can enhance **patient engagement** and **adherence** by providing clear, objective feedback on their progress, fostering greater confidence in the rehabilitation process. Despite some variability, the integration of HHDs into clinical practice can lead to **more precise interventions** and better overall care for musculoskeletal patients.

Search timeframe (2014-2024)

State the dates you wish your search to cover

Search criteria same font

Population Intervention Comparison Outcomes (PICO) themes	**Description**	**Search terms**
Population and Setting E.g. adults with OA, primary care	Individuals with musculoskeletal (MSK) conditions (e.g., older adults, people with strength weakness	Adult
Intervention or Exposure (i.e. what is being tested) e.g. manual therapy	Hand-held dynamometers (HHDs) for measuring muscle strength	Handheld Devices Oxford Scale Muscle strength testing Manual muscle strength testing Handheld dynamometer
Comparison, if any e.g. usual care, leaflet	Other muscle strength measurement methods (e.g., isokinetic dynamometers, manual muscle testing)	Comparison to gold standard static biodex isokinetic dynamometer Kin Kon
Outcomes of interest e.g. Visual analogue scale, Range of motion	Validity, reliability, and accuracy of muscle strength measurement	Reliability Validity
Types of studies e.g. Randomised Controlled Trails, Systematic reviews		RCT's Systematic reviews

Databases searched

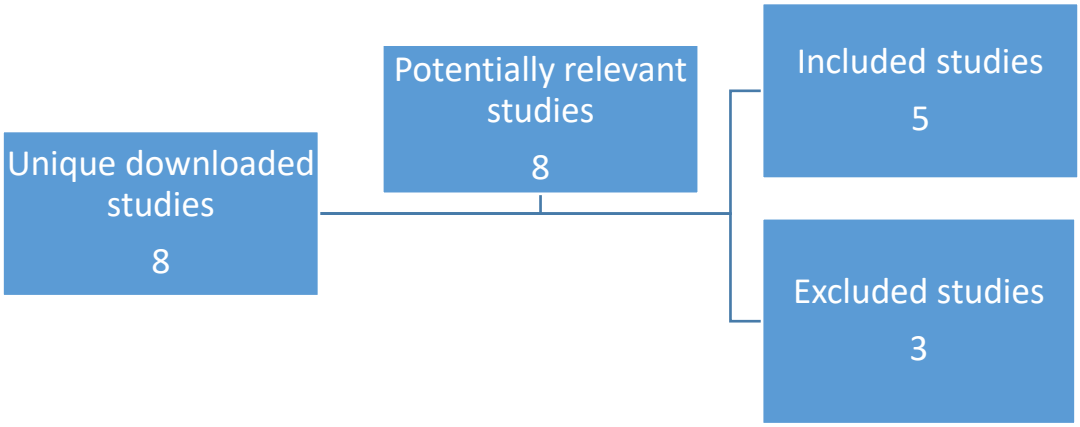
Include the databases searched, below are examples of databases you may use:

Clinical Knowledge Summaries (CKS), Physiotherapy Evidence Database (PEDro), British Medical Journal (BMJ) Updates, Clinical Evidence, Translation of Research into Practice (TRIP) Database, National Institute for Clinical Excellence (NICE), Health Technology Assessment (HTA), Bandolier, The Cochrane Library, Medline, Cinahl, Embase, PsycInfo, Professional websites, Joanna Briggs Institute, Web of Science, Sports discus and Pub Med

Date of search

April 2024

Results of the search: include the number in each box



There were 8 number of unique downloaded studies. There were 5 number of relevant studies. There were 5 numbers included, and their critical appraisal is included in Table 1. There were 3 excluded studies.

Table 1- Detail of included studies

First author, year and type of study	Population and setting	Intervention or exposure tested	Study results	Assessment of quality and comments
Croteau, F et al 2021	19 male and 20 female elite water polo players (sports setting)	Hand-held dynamometer (HHD) vs. isokinetic dynamometer for measuring shoulder strength (external and internal rotation)	Strong to very strong correlations between the devices (ρ = 0.65–0.82, P < 0.01) for absolute internal and external rotation strength; moderate agreement for the ER/IR ratio (ρ = 0.29). Intertrial variability was low (ICC 0.88–0.93). HHDs are considered reliable for shoulder strength measurement in elite athletes.	High-quality study with clear methodology. Strengths include the use of a comparative gold standard (isokinetic dynamometer) and well-defined population. Some limitations in agreement at higher torque values and the need for strong evaluators for stronger players.
Ishøi, L. et al 2023	49 healthy adults (sports medicine setting)	HHD for maximal and explosive muscle strength (hip adduction squeeze and hip abduction press tests)	Good intra- and inter-tester reliability for maximal strength (ICC: 0.93–0.97 for adduction, ICC: 0.88–0.92 for abduction). Explosive strength showed moderate to good reliability	High-quality study: findings suggest that HHDs are reliable for assessing maximal strength in both tests but highlights challenges in explosive

			(ICC: 0.71–0.87), with better consistency for intra-tester than inter-tester measurements.	strength testing across different testers. The study contributes valuable insights into explosive strength measurement with HHDs.
Beshay, N et al 2021	12 asymptomatic and 11 symptomatic shoulders (clinical setting)	HHD vs. fixed dynamometer for shoulder strength measurements (internal rotation, external rotation, abduction, adduction, lift-off)	Both HHD and fixed devices showed excellent intra-rater and inter-rater reliability (ICC > 0.80). The reliability of HHD decreased for stronger individuals during scapular plane abduction.	High-quality study; provides strong evidence for HHD's reliability in clinical practice. Notable for its practical recommendations about using stabilization for stronger subjects to enhance reliability in certain movements. Small numbers
Schaeffer, M et al 2021	26 pre-professional dancers (age 20.64 ± 2.21 years) (dance medicine and science setting)	HHD for measuring lower extremity strength (hip, knee, ankle muscle groups)	HHD showed good inter- and intra-rater reliability for most muscle groups (ICC > 0.75). Some reliability issues were noted for knee extension and ankle eversion.	Moderate quality study. The study is relevant for dance medicine as it supports HHDs as a reliable tool for assessing lower extremity strength in dancers. The absence of external fixation devices (used in

				other studies) could be considered a strength, as it makes the assessment more practical in real-world settings.
Gobbo, S. et a Journal article; Reliability study 2019	30 healthy young adults (university students)	Isokinetic and isometric strength testing (knee and ankle flexion and extension) vs. HHD	High intra-class correlation coefficients (ICC > 0.7) for both isometric and isokinetic strength measurements across knee and ankle joints. Paired-sample t-tests showed no significant differences between tests.	High-quality study. Demonstrates that both isokinetic and isometric testing protocols can be reliably used for knee and ankle assessments in healthy adults. This supports the use of HHD in clinical settings for these joint assessments.

Summary

The studies referenced above provide evidence for the **reliability** and **validity** of HHDs across various muscle groups and populations (athletes, dancers, general adults, etc.). However study numbers are small and should be viewed with caution. Further research is needed into older adults with MSK conditions.

In clinical practice, **HHDs are a practical tool** for muscle strength testing, with **excellent reliability** when proper testing procedures (like stabilization) are followed.

Implications for practice

Practical and Cost-Effective Tool:
HHDs provide a **cost-effective, accessible** option for measuring muscle strength in MSK

clinics. They can be easily integrated into routine clinical assessments without requiring expensive equipment or complex setup.

Improved Treatment Tailoring:
HHDs allow clinicians to obtain **objective measurements** of muscle strength, enabling more **individualised treatment plans** that target specific weaknesses, leading to more effective rehabilitation.

Patient Engagement and Adherence:
By providing clear, quantifiable data on muscle strength, HHDs can improve **patient engagement**, increase **self-efficacy**, and promote **adherence** to prescribed exercise programs, enhancing overall outcomes.

Consistency in Testing Protocols:
To improve reliability, it is essential for clinics to adopt **standardised testing protocols** (e.g., stabilization techniques and testing procedures) to minimize variability in results, especially between different testers.

Caution with Stronger Populations:
HHDs may be less reliable when assessing **higher strength outputs** (e.g., in athletes or highly trained individuals). Clinicians should be cautious when using HHDs with these populations and consider using additional methods for accurate muscle strength measurement.

Further Research Needed:
Research should focus on comparing HHDs with **manual muscle testing** (e.g., Oxford Scale) and **isokinetic dynamometers**, as well as investigating their impact on patient outcomes in clinical practice.

What would you post on social media?

Hand-held dynamometers (HHDs) are a **reliable** and **cost-effective** way to measure muscle strength in athletic populations. While results can vary between testers, they help create **personalised treatment plans** and improve **patient motivation** in rehab. Further research is needed.

References

Croteau, F., Robbins, S. M., & Pearsall, D. (2021). Hand-Held Shoulder Strength Measures Correlate With Isokinetic Dynamometry in Elite Water Polo Players. *Journal of Sport Rehabilitation, 30*(8), 1233-1236. https://doi.org/10.1123/jsr.2020-0277

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Please tick the box that best reflects your clinical bottom line and include the picture on page 1

CAT image	Evidence quality	Checkbox
	Good quality evidence to support use….	☑
	Insufficient or poor-quality evidence OR substantial harms suggest intervention used with caution after discussion with patient…	☐
	No good quality evidence, do not use until further research is conducted OR Good quality evidence to indicate that harms outweigh the benefits….	☐

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