

Pelvic Physical Therapy Distance Journal Club

August 9, 2023

Melissa Caywood, PT, DPT

Board Certified Clinical Specialist in Women's Health Physical Therapy (WCS)

Therapeutic Neuroscience of Pain Education (TPS-certified)

Methods used to investigate tone of pelvic floor muscles in pelvic health conditions: A systematic review. Worman R, Stafford RS, Cowley D, Hodges PW. *Continence*, Volume 6, 2023,100593, ISSN 2772-9737, doi.org/10.1016/j.cont.2023.100593.

Aim:

Systematically review the literature to determine which tools and outcome measures have been used to assess increased tone of pelvic floor muscles (PFMs) in pelvic health conditions.

(Background: measurement of muscle tone is not well-defined, and interpretation is complicated by measurement issues.

The authors describe tone of the PFMs as it “relates to the change in force per unit length change and includes active (muscle activation) and passive contributions. The passive or viscoelastic component depends on many elements including the actin–myosin cross-bridges, mechanical properties of the contractile proteins, non-contractile connective tissues, and osmotic pressures of cells. The active element is regulated by neural mechanisms from spinal, brainstem and subcortical and cortical networks.”)

Study Design:

Systematic review

The authors' search terms can be found in an online appendix.

Results:

After screening almost 8,000 references, the authors identified 151 papers that used 103 outcome measures from eight measurement tools.

The eight tools to evaluate increased PFM tone were: EMG, dynamometry, manometry, digital palpation, MRI, ultrasound, defecography, and other. Clinical examples of tools in the other category familiar to physical therapy include visual inspection and assessment of perineal descent.

For each tool, the authors defined which property of muscle tone was measured: active, passive, or combined.

For each outcome measure, rationale for use was identified, any description of reliability and validity was recorded, and application issues affecting interpretation were identified (eg, placement of dynamometer)

With use of the eight tools, 103 outcome measurements were described. Extensive detail is provided in chart form in the article. (see a summary in the attached document--Table of Tools) Direct measures of PFM electrical amplitude can be performed with EMG, and direct measure of pressure can be performed with manometry. All other outcome measures indirectly assessed PFM tone without validation. Repeatability was acceptable, but scientific strength of the measures were weakened by many application issues that diminished accuracy.

Suggestion from Rachel Worman: "Indirect measures that have good to strong correlation to a gold standard direct measure are considered to have face validity, meaning that it *appears* that they measure what is intended to be measured. Direct measures that have good to strong correlation to a gold standard direct measure can be considered valid. Many authors have interpreted that a measure is valid, but this is in error if they have validated it against an indirect measure (eg, digital palpation measured against ultrasound could not be considered valid as ultrasound in an indirect measure)."

#### Discussion:

- Few measures provide direct measures of tone.
- Most measures cannot distinguish between active and passive elements of tone.
- Few outcomes have been validated as measures of increased tone.
- Tools require careful application and reporting to control for multiple issues that can influence data interpretation.

#### Strengths/weaknesses:

##### Strengths:

Treasure trove of information

The article identified measurement tools and outcome measures used to evaluate increased PFM tone.

From the summary tables, there are some outcome measures that appear to be more reliable and could be used as a measure of tone (eg, EMG and manometry).

##### Weaknesses:

The review did not undertake a systematic review of repeatability and validity for each measure.

#### Conclusion/Summary:

- Many measures have been used to interpret increased PFM tone in pelvic health conditions. The authors state they were unable to find evidence to support the validity of many measures of increased tone. Their findings agree with other reports.
- According to the information presented in the article, EMG and manometry are the tools with the best scientific quality.

- Tools that should be used with caution to guide critical thinking and differential diagnosis in re: to PFM tone are visual inspection and palpation.
- The presence of tenderness does not equal or determine “increased” tone of the PFMs.

#### Clinical Application:

The information in the paper may apply more to clinical research and study design but does contribute to the body of clinical knowledge and informs clinicians about available measurement tools and scientific quality. This information helps to inform clinical reasoning, guide differential diagnosis and treatment planning.

EMG is the measurement tool with the highest level of reliability and validity. However, sEMG requires normalization to account for differences in amplitude caused by different electrode properties, inter-electrode distance, subcutaneous tissues, etc. Without normalization, sEMG amplitude measures are variable and do not allow for comparison between days or groups. Many exceptions and issues exist with the application of sEMG.

With expert technicians, ultrasound can provide accurate measurements. The measure, however, is an indirect measure of tone and results can be attributed to other causes.

Dynamometry and manometry measures of the PFMs at rest can provide valid data of increased tone, particularly if individual differences in anatomical dimensions are taken into account.

The remaining measurement tools and other outcomes measured with EMG, dynamometry and manometry can only provide indirect assessment of increased tone. Very few have been validated as measures of increased tone.

Digital palpation of pelvic floor muscles has extremely low scientific strength.

Tenderness has not been validated as a measure of greater than normal tone.

Clinical techniques such as visual inspection and assessment of perineal descent are included in the “other” category. They are indirect measures and results can be attributed to other causes. There are many issues with the application of the measurement and these tools are of low scientific quality.

#### Discussion questions:

In this article, Worman used this definition of tone—“Tone of the PFM relates to the change in force per unit length change [a mathematical definition] and includes active (muscle activation) and passive contributions.” How does this apply/inform your clinical practice? (“Maybe tone is not as important as we have made it out to be”—B. Shelly.) In orthopedic PT we do not strive to measure or describe muscle tone except with a neural diagnosis. Do we need to be concerned with this in pelvic PT? Are we measuring tone or

something else—facial mobility, tenderness? Are we interacting/influencing the nervous system and then the outcome is a change in the muscle function when we are talking about tone?

After reading this article, if not limited by cost/access, etc., what tool/s would you chose to measure PFM tone?

What types of tools were you exposed to in your education or residency?

What factors could be controlled in the clinic to address application issues raised by the article (i.e., sEMG electrode placement, set up; modification of language in documentation—specify tenderness/pain and greater than average tone/tension with palpation)?

#### References:

Binder-Markey B, Sychowski D, Lieber R. Systematic review of skeletal muscle passive mechanics experimental methodology. *Journal of Biomechanics*. 2021: 129.

Ganguly J, Kulshreshtha D, Almotiri M, Jog M. Muscle Tone Physiology and Abnormalities. *Toxins (Basel)*. 2021 Apr 16;13(4):282. doi: 10.3390/toxins13040282. PMID: 33923397; PMCID: PMC8071570.

Shortland A.P. Muscle tone is not a well-defined term. *Dev. Med. Child Neurol*. 2018;60:637. doi: 10.1111/dmcn.13707.

Simons G.D., Mense S. Understanding and measurement of muscle tone as related to clinical muscle pain. *Pain*. 1998;75:1–17. doi: 10.1016/S0304-3959(97)00102-4.