

Moving toward stronger evidence to corroborate the relevance of neurodynamic assessments and interventions for individuals with carpal tunnel syndrome: Isn't it time to adopt a standardized measurement protocol when using quantitative ultrasound imaging?

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Background

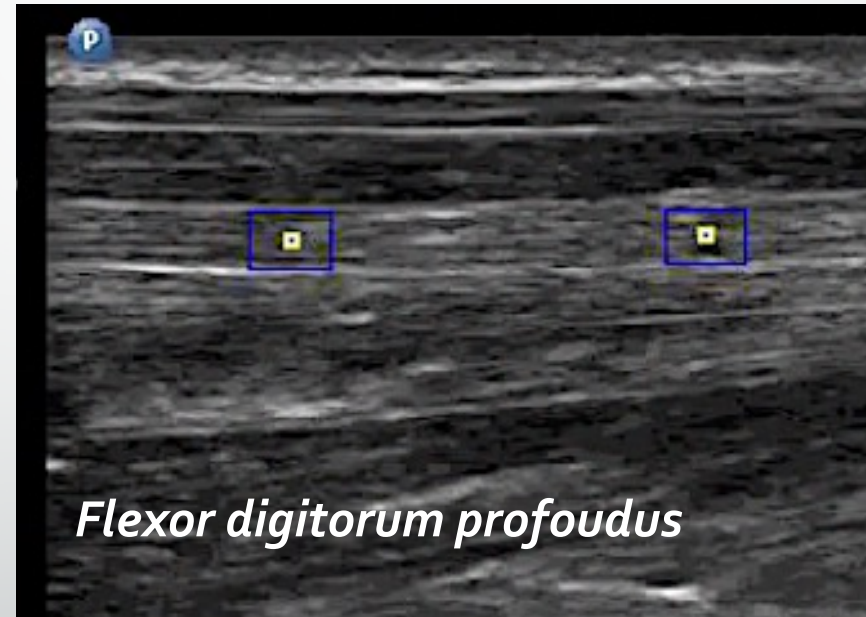
- Physiotherapists often advocate neurodynamic assessments and treatments for individuals with carpal tunnel syndrome
- Impaired median nerve excursion may play an extensive role in symptoms onset and clinical evolution (Elis et al., 2017)
- Additional evidence is needed to confirm these findings
 - Quantitative ultrasound imaging (QUI) allows to assess neurodynamics in research environments and may easily transfer into clinical practice

Background

- QUI allows dynamic evaluation of the median nerve, including longitudinal excursion measurement
- Excursion measurement can be performed parallel to the structure of interest by a single evaluator in a controlled environment



a



← Median nerve

b

Figure: a) exemple of an evaluation of median nerve excursion with, b) corresponding ultrasound image

Background

- Amount of median nerve excursion reported in the literature vary between 2.1 mm and 15.5 mm
- Measurement protocols for the median nerve, including QUI, vary extensively across studies

Authors	Joint motion	Median nerve excursion
Dilley et al. (2003)	Wrist extension (0° to 40°)	4.7 mm
Brochwicz et al. (2013)	Passive C5-C6 glide	2.5 mm
Gonzalez-suarez et al. (2015)	Wrist extension (0° to 60°)	15.5 mm
Filius et al. (2015)	Active finger flexion from full extension to full flexion	4.0 mm

Purpose

- **To synthesize the literature focusing on QUI assessment of the median nerve and propose a standardized measurement protocol**
 - The development of an evidence-based standardized QUI assessment protocol is crucial to characterize median nerve neurodynamics and promote further investigation of nerve-gliding-type interventions, especially in individuals with carpal tunnel syndrome

Method



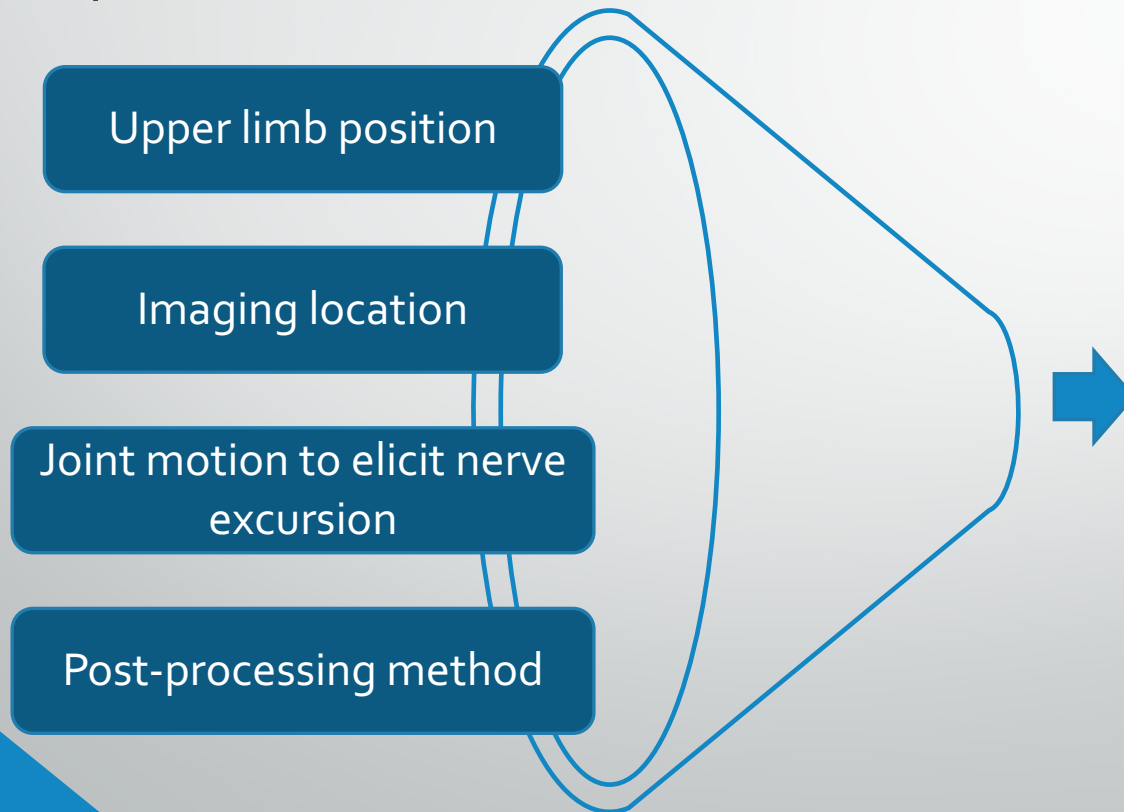
- Systematic search was performed in the following databases
 - MEDLINE (1946 - december 2017), Embase (1974 – december 2017), CINAHL (1981 – december 2017)
- Studies reporting psychometric properties of quantitative median nerve measures on human participants were included
 - Relevant keywords and subject headings were determined with the help of a professional librarian
- The methodological quality of each study was assessed by two reviewers (PP, VL) using the COSMIN checklist
- A critical narrative analysis of the median nerve excursion assessments was performed to guide our proposition

Results: Summary of findings

Authors (year)	Sample	Main outcome	Methodological quality
Hough et al. (2000)	N=16	Repeatability : ICC (1,1) = 0.92; MDC _{95%} = 1.6 mm (relative = 17.78%)	Good
Dilley et al. (2001)	Two groups; 1) N=3, 2) N=7	Criterion validity: Absolute error < 25 μ m	Poor
Greening et al. (2001)	Two groups; 1) N= 4, 2) N=5	Measurement difference = 0.2 mm	Poor
Coppieters et al. (2009)	N=10	Inter-rater reliability: ICC = 0.96; MDC _{95%} = 1.84 mm (relative = 18%)	Poor
Van Doesburg et al. (2010)	N=15	Intra-rater reliability: ICC = 0.812	Poor
Filius et al. (2013)	N=20	Intra-rater reliability: ICC = 0.91	Fair
Gonzalez-Suarez et al. (2015)	N=6	Repeatability: ICC = 0.78 ; MDC _{95%} = 0.16 mm (relative = 16%)	Good
Martinez-paya et al. (2015)	N=22	Inter-rater reliability: k=0.83	Poor

Results: Critical narrative analysis

- Common methodological elements of studies with the best psychometric qualities included:



Formulation of a standardized protocol

1. Evaluation in supine with the arm resting alongside
2. Ultrasound imaging acquisition over the carpal tunnel
3. Passive wrist extension performed to elicit nerve excursion
4. Post-processing using speckle-tracking image analysis

Conclusion

- Using a standardized measurement protocol, incorporating the four aforementioned elements, is encouraged to generate aggregated data across studies and collectively strengthen evidence on neurodynamic assessments and interventions for individuals with carpal tunnel syndrome
- Acknowledgements:



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