

Journal Pre-proof

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PII: S0003-9993(24)01165-1
DOI: <https://doi.org/10.1016/j.apmr.2024.07.016>
Reference: YAPMR 59191



To appear in: *Archives of Physical Medicine and Rehabilitation*

Received date: 28 December 2023
Revised date: 1 July 2024
Accepted date: 18 July 2024

Please cite this article as: Carlos Murillo PhD , Ester Cerezo-Téllez PhD ,
María Torres-Lacomba PhD , Thien Quy Pham BS , Enrique Lluch PhD , Deborah Falla PhD ,
Tat-Thang Vo PhD , Unravelling the mechanisms behind the short-term effects of dry needling: new
insights from a mediation analysis with repeatedly measured mediators and outcomes., *Archives of
Physical Medicine and Rehabilitation* (2024), doi: <https://doi.org/10.1016/j.apmr.2024.07.016>

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Unravelling the mechanisms behind the short-term effects of dry needling: new insights from a mediation analysis with repeatedly measured mediators and outcomes.

Short running head: insights into the mechanisms of dry needling

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Acknowledgments

The authors thank the Physiotherapy in Women's Health Research Group of the Physical Therapy Department at Alcala University, Madrid for providing the material required for the study and the Primary Healthcare Regency and Primary Healthcare Centre Juan de Austria for providing the facilities to develop the study. CM is supported by Fonds Wetenschappelijk Onderzoek-FWO (G001419N).

Authors' Contributions statement

CM, T-TV, DF, EL, EC-T and MT-L contributed to the conceptualization of this work. EC-T and MT-L acquired the data. CM, T-TV and T-QP analyzed and interpreted the data. CM

Table 1. Patient's baseline characteristics. Mean and standard deviation.

	DDN+stretching (N=64)	Stretching alone (N=64)	Total (N=128)
Sex			
Women	36 (56.3%)	45 (70.3%)	81 (63.3%)
Men	28 (43.8%)	19 (29.7%)	47 (36.7%)
Age	48.0 (15.7)	52.0 (15.6)	50.0 (15.8)
NDI	14.6 (7.06)	14.6 (5.97)	14.6 (6.51)
VAS	5.08 (1.60)	5.05 (1.44)	5.07 (1.52)
PPT	2.13 (0.59)	2.16 (0.58)	2.14 (0.58)
ROM	105 (18.00)	103 (16.60)	104 (17.30)
Neck strength	94.8 (38.6)	90.1 (33.5)	92.4 (36.1)
DDN, deep dry needling; NDI, Neck Disability Index; PPT, Pressure Pain Threshold; ROM, range of motion; VAS, Visual Analogue Scale.			

Table 2. Results of mediation analyses for the outcomes neck-pain related disability and pain intensity. Point and uncertainty estimates for total, direct and indirect effects at each timepoint.

Timepoint	Outcome: Neck pain-related disability			Outcome: Neck pain intensity		
	Total effect	Indirect effect	Direct effect	Total effect	Indirect effect	Direct effect
M1: local PPT				M1: local PPT		
Post-intervention	-5.31 (-7.45, -3.17)	-1.52 (-3.42, 0.39)	-3.80 (-6.40, -1.19)	-3.22 (-3.69, -2.74)	-0.45 (-0.81, 0.09)	-2.76 (-3.37, -2.15)
2-week follow-up	-5.72 (-7.81, -3.62)	-2.05 (-4.00, -0.09)	-3.67 (-6.26, -1.09)	-3.06 (-3.54, -2.58)	-0.44 (-0.80, 0.09)	-2.61 (-3.19, -2.04)
4-week follow-up	-6.13 (-8.23, -4.02)	-1.79 (-3.72, 0.15)	-4.34 (-6.88, -1.80)	-3.14 (-3.62, -2.66)	-0.57 (-0.90, 0.23)	-2.57 (-3.16, -1.98)
M2: cervical ROM				M2: cervical ROM		
Post-intervention	-5.31 (-7.45, -3.17)	-1.38 (-3.00, 0.24)	-3.93 (-6.26, -1.60)	-3.22 (-3.69, -2.74)	-0.16 (-0.47, 0.16)	-3.06 (-3.57, -2.55)
2-week follow-up	-5.72 (-7.81, -3.62)	-1.91 (-3.55, -0.27)	-3.81 (-6.16, -1.46)	-3.06 (-3.54, -2.58)	-0.29 (-0.60, 0.01)	-2.77 (-3.28, -2.26)
4-week follow-up	-6.13 (-8.23, -4.02)	-1.67 (-3.32, -0.01)	-4.46 (-6.77, -2.15)	-3.14 (-3.62, -2.66)	-0.25 (-0.52, 0.02)	-2.89 (-3.37, -2.40)
M3: neck muscle strength				M3: neck muscle strength		
Post-intervention	-5.31 (-7.45, -3.17)	0.16 (-0.78, 1.10)	-5.48 (-7.59, -3.36)	-3.22 (-3.69, -2.74)	0.10 (-0.10, 0.31)	-3.32 (-3.78, -2.85)
2-week follow-up	-5.72 (-7.81, -3.62)	0.01 (-0.86, 0.87)	-5.73 (-7.71, -3.75)	-3.06 (-3.54, -2.58)	0.05 (-0.16, 0.26)	-3.11 (-3.56, -2.67)
4-week follow-up	-6.13 (-8.23, -4.02)	0.06 (-0.81, 0.92)	-6.18 (-8.19, -4.17)	-3.14 (-3.62, -2.66)	-0.02 (-0.20, 0.16)	-3.12 (-3.55, -2.69)
M4: pain intensity						
Post-intervention	-5.31 (-7.45, -3.17)	-3.45 (-5.94, -1.00)	-1.84 (-4.75, 1.06)			
2-week follow-up	-5.72 (-7.81, -3.62)	-2.47 (-4.76, -0.17)	-3.25 (-6.12, -0.39)			
4-week follow-up	-6.13 (-8.23, -4.02)	-4.80 (-7.17, -2.43)	-1.32 (-4.21, 1.56)			