

LETTER TO THE EDITOR

VERIFYING THE HYPOTHESIS OF OVERWORK WEAKNESS IN CHARCOT-MARIE-TOOTH

Sir,

In 2003, Vinci et al. (1) hypothesized that patients with Charcot-Marie-Tooth (CMT) may have overwork weakness, based on their finding in 106 patients with CMT that the dominant hand was significantly weaker than the non-dominant hand. This finding has been challenged by van Pomeran et al. (2), who found no difference in muscle strength between the hands in a population of 28 patients with CMT type I or II. In a Letter to the Editor (3), the conflicting results of both studies were discussed further, and in the Response research groups are encouraged to verify the hypothesis of overwork weakness in their CMT samples. We have recently performed a study on hand function in 49 patients with CMT1A (4, 5). Because of the direct implications of overwork weakness for rehabilitation and lifestyle advice given to CMT patients, we re-analysed our data to evaluate a possible presence of overwork weakness in our population.

Our study population comprised 49 DNA-confirmed type 1A CMT patients, between 18 and 70 years of age, who were known at the Departments of Rehabilitation and Neurology at the Academic Medical Center (AMC), University of Amsterdam, The Netherlands (4, 5). Isometric hand strength (grip, 2-point, tripod, and lateral pinch strength) was measured quantitatively using digital handgrip dynamometers (Lode Medical Technology, Lode Medical Technology BV, Groningen, The Netherlands) according to a standardized testing procedure (6). The mean force in Newtons (N) of 3 trials was recorded for all strength measurements.

Seventy-eight percent of the CMT1A patients reported hand involvement. A large variation in hand strength was found, with grip strength of the dominant hand in the range 42–544 N. No significant differences between the dominant and non-dominant hands were found for grip, 2-point, tripod and lateral pinch strength measurements (paired samples *t*-tests).

Vinci et al. emphasized that overwork weakness may appear especially in more severely affected CMT patients. Therefore, we re-analysed hand strength differences in subgroups with less and more severely affected patients (i.e. tripod pinch strength of the dominant hand equal to/above or below the 50<sup>th</sup> percentile score, 43 N, of the total group). Tripod pinch strength, a frequently used grip pattern in daily activities, was used to define subgroups, as in CMT1A the intrinsic muscles become primarily affected, influencing this functional pinch grip.

In the subgroup of patients with less affected hand function (*n* = 27) all mean values for grip and pinch strength were higher in the dominant hand, although these differences did not reach statistical significance. The mean and standard deviation (SD) value of tripod pinch strength, for example, was 63.3 (SD 17.0) N for the dominant hand compared with 60.2 (SD 17.6) N for the non-dominant hand. By contrast, in the more severely affected subgroup (*n* = 22) pinch strength in the dominant hand was significantly lower (*p* = 0.015) than in the non-dominant hand; 17.3 (SD 14.5) and 23.1 (SD 19.8), respectively

In conclusion, in more severely affected CMT1A patients the dominant hand was found to be weaker, which may fit with the hypothesis of overwork weakness. Nevertheless, before advising patients to limit the use of their hands in daily life, further, preferably longitudinal and electrophysiological, research is needed to identify the underlying mechanisms of muscle strength difference between the hands.

Submitted January 20, 2010; accepted February 25, 2010

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RESPONSE TO LETTER TO THE EDITOR BY VIDELER ET AL.

We have read the valuable contribution of Videler et al. on signs of overwork weakness in patients with Charcot-Marie-Tooth (CMT). As in our study (2), overall, Videler et al. did not find a difference between the dominant and non-dominant hands in their CMT patients. This is in contrast with the study of Vinci et al. (1), who, using manual muscle strength testing, found a stronger dominant hand in only 2 out of 212 muscles and a stronger non-dominant hand in 139 of these 212 muscles.

When selecting only the more severely affected patients, Videler et al. did find in this group of 22 patients a small, but

significantly stronger, non-dominant hand for the tripod pinch. We agree with Videler that the latter finding may fit with the hypothesis of overwork weakness. However, it should be noted that the difference in strength between both hands for the tripod pinch is relatively small and that the non-dominant hand is also severely weakened. Therefore, it is unclear if this difference is clinically relevant. As suggested by Videler et al., larger prospective cohort studies or interventions studies, preferably using more specific measures of intrinsic hand muscle function (e.g. (7)) would be needed to conclude on the presence of overwork weakness.

In summary, in the absence of a mechanism to explain overwork weakness in this population and in the absence of any data indicating that reducing activity would slow disease progression, we still feel that there is insufficient evidence to conclude that overwork weakness exists, and agree with Videler et al. that, at present, there are no grounds to advise patients to limit their activities.

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#### REFERENCES

1. Vinci P, Esposito C, Perelli SL, Antenor JA, Thomas FP. Overwork weakness in Charcot-Marie-Tooth disease. *Arch Phys Med Rehabil* 2003; 84: 825–827.
2. van Pomeran M, Selles RW, van Ginneken BT, Schreuders TA, Janssen WG, Stam HJ. The hypothesis of overwork weakness in Charcot-Marie-Tooth: a critical evaluation. *J Rehabil Med* 2009; 41: 32–34.
3. Vinci P, Perelli SL, Gargiulo P. About the hypothesis of overwork weakness in Charcot-Marie-Tooth disease. *J Rehabil Med* 2009; 41: 778.
4. Videler AJ, Beelen A, van Schaik IN, de Visser M, Nollet F. Manual dexterity in hereditary motor and sensory neuropathy type 1a: severity of limitations and feasibility and reliability of 2 assessment instruments. *J Rehabil Med* 2008; 40: 132–136.
5. Videler AJ, van Dijk JP, Beelen A, de Visser M, Nollet F, van Schaik IN. Motor axon loss is associated with hand dysfunction in Charcot-Marie-Tooth disease 1a. *Neurology* 2008; 71: 1254–1260.
6. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: normative data for adults. *Arch Phys Med Rehabil* 1985; 66: 69–74.
7. Selles RW, van Ginneken BT, Schreuders TA, Janssen WG, Stam HJ. Dynamometry of intrinsic hand muscles in patients with Charcot-Marie-Tooth disease. *Neurology* 2006; 67: 2022–2027.