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## Case Report

### Carpal Tunnel Syndrome in the Digital Era - Are Electronic Health Records and Wrist Pedometers Potentially Synergistic Risk Factors?

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## Abstract

A 53-year-old right-handed healthy male health care professional presented with 2.5 months of numbness and tingling in the left median nerve distribution, consistent with carpal tunnel syndrome. Six weeks before symptom onset, his hand use for keyboarding had increased because of the implementation of an electronic health record system and he began wearing a circumferential left-wrist electronic pedometer. The increased repetitive finger flexor motion, altered wrist flexion/extension angle while typing, and mild circumferential compression of the flexor tendons and median nerve likely led to his symptoms. He had no upper extremity clubbing, cyanosis, or edema but had mild bilateral thumb carpometacarpal joint arthritis with minimal osteophytes and slight subluxation. Although his symptoms improved after eliminating the wrist pedometer and using a wrist splint for proper ergonomics, it is premature to state that wearing an electronic wrist pedometer will cause carpal tunnel syndrome. However, during the one-year follow-up visit, the patient reports no further issues since removing the electronic wrist pedometer and maintaining regular daily activities. As a result, we recommend several precautions for wrist pedometer use.

## Introduction

Multiple potential causes are implicated in the development of carpal tunnel syndrome (CTS) [1-2]. Risks factors include obesity, female sex, diabetes, rheumatoid arthritis, and a family history of CTS [3]. To our knowledge, no conclusive research is available to support repetitive motion as the sole cause [3]. We present the successful treatment of symptoms and one-year follow-up consistent with CTS in an otherwise healthy male health care professional.

## Case report

A right-handed 53-year-old male presented with 2.5 months

of tingling and numbness in the left index and middle fingers and stiffness in finger and wrist flexion and extension. Six weeks before symptom onset, his computer keyboarding had increased because of the implementation of an electronic health record at his institution, and he had concurrently started to wear a circumferential left-wrist electronic pedometer (Figure 1) that was adjusted to fit comfortably (Figure 2). Initially the numbness, left-wrist swelling, and discomfort with flexion and extension would occur only after keyboarding. Later, the symptoms persisted for more than 30 minutes even after cessation of typing and removing the wrist pedometer. He also developed wrist and hand discomfort with pronation and supination. He had also noticed the pedometer dented the palmar wrist soft tissue when typing

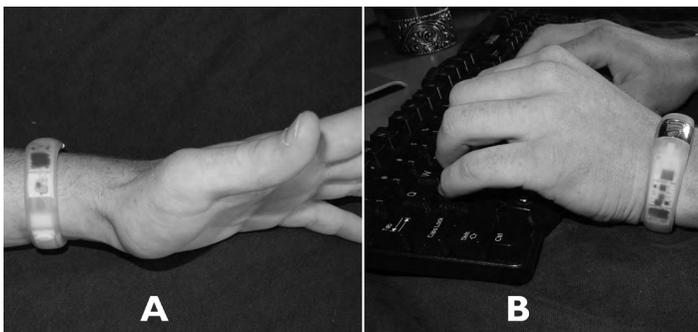
for more than 3 hours. The depression would last for approximately 10 minutes after pedometer removal.



**Figure 1.** A commercially available electronic wrist pedometer. A) Oblique view; B) Axial view with ruler.

Approximately 1 week before his medical evaluation appointment, he experimentally stopped wearing the pedometer and started wearing a prefabricated wrist splint during the evenings and while sleeping. He continued to use the computer keyboard in similar capacity. His symptoms improved.

On examination, he had no upper extremity clubbing, cyanosis, or edema. His fingers were well vascularized, with intact sensation to light touch. His finger and wrist range of motion was not restricted. Tinel's sign was negative at both wrists, forearms, and elbows. He had a negative Finkelstein's sign and negative thumb carpometacarpal joint grind tests bilaterally. His thenar eminences showed no atrophy. The palmaris longus tendon was not palpable at either wrist. Grip strength was 100 and 70 pounds on the right and left, respectively. Pinch strength was 23 and 20 pounds on the right and left, respectively. Radiographs showed mild bilateral thumb carpometacarpal joint arthritis with minimal osteophytes and slight subluxation. There were no acute changes.



**Figure 2.** Views of the left wrist with the wrist pedometer. A) Radial view; B) Dorsal-ulnar view while typing.

The patient's symptoms, consistent with early left CTS, were possibly caused by the increased repetitive keyboarding, exacerbated by the pedometer's compression. Because they had improved with eliminating one of the potential causative factors (wrist pedometer) and instituting proper ergonomics with the wrist splint, we recommended continuation of the wrist splint until his symptoms resolved and, should symptoms persist or

recur, clinical and electrical evaluation with a Nerve Conduction Velocity Study and electromyography.

The diagnosis of carpal tunnel syndrome has been and is still made based on clinical history and clinical examination. Only within the last twenty-five years or so has the use of electrical studies become incorporated as a routine part of the diagnostic tools. In some practices, the initial diagnosis of carpal tunnel syndrome is still made on clinical history and clinical findings. The electrical studies are ordered to confirm and to grade the severity of the median nerve compression and also to determine if surgical intervention is needed if conservative treatment is ineffective. The use of ultrasound has not been used in the senior author's practice in the diagnosis of carpal tunnel syndrome. A recent addition to the diagnostic tools has been magnetic resonance neurography, which can produce topographic images of the nerves in question. The magnetic resonance neurography is helpful in visualizing topographic changes in the nerves that could, in concert with an electromyography and Nerve Conduction Velocity Study, confirm the diagnosis of carpal tunnel syndrome.

However, in a one-year follow-up visit for symptoms consistent with early CTS, the patient reports no further issues since removing the electronic wrist pedometer and maintaining regular daily activities.

## Discussion

Although most cases of CTS are attributed to idiopathic origins, our patient's history suggested increased hand use exacerbated by the wearing of a circumferential inflexible wrist pedometer.

The median nerve at the level of the distal forearm/wrist is fairly superficial and is usually separated from the overlying skin only by a thin flat palmaris longus tendon, which was absent in our patient. The little subcutaneous adipose tissue at this level increases the median nerve's susceptibility to irritation and compression, as reflected by our patient's Tinel's sign over the median nerve. Our patient also had agenesis of bilateral palmaris longus. The literature is divided as to whether the presence of the palmaris longus increases or decreases the risks of developing CTS [4-5].

It is premature to state that wearing an electronic wrist pedometer will cause CTS. However, in our patient, we postulate that the combination of increased repetitive finger flexor motion, alteration of the wrist flexion/extension angle while typing, and mild circumferential compression of the flexor tendons and the median nerve at the wrist led to the onset of his symptoms. This hypothesis is supported by the fact that there was clinical improvement shortly after he stopped wearing the wrist pedometer and began wearing a wrist splint intermittently, with no alteration in keyboarding. Therefore, wearing a wrist pedometer seems to have played a role in the devel-

opment of numbness in the median distribution and discomfort in a wrist susceptible to median nerve irritation from increased repetitive motion.

The recent emergence of electronic pedometers from prominent sports and technology companies provides another option for those in pursuit of a healthier lifestyle [6], one that may also increase weight loss [7]. A 2009 systematic review, which included 26 studies and a total of 2767 participants, examined the association of pedometer use and physical activity and indicated that individuals who wore a pedometer walked at least 2000 more steps (approximately 1 mile) each day than non-pedometer users [7]. Pedometer users also had a 27% increase in their physical activity levels over a mean exercise intervention time of 18 weeks (range: 3 to 104 weeks) [7]. Consumer interest has also increased since major sporting companies added logos to the pedometers; these pedometers have been touted by at least one magazine as “must-have” stylish athletic accessories [8]. However, just as the increased prevalence and use of computer keyboarding enhanced the knowledge of ergonomics in the work place, it is important to understand these pedometer devices because they may produce unexpected effects on the human body, as evidenced by the recent recall of some pedometers because of skin rashes [9].

## Conclusion

This case builds on existing knowledge implicating circumferential structures worn around the wrist in CTS [10] and is timely given increased implementation of electronic health records in the context of “meaningful use” incentives and the recent rise in the popularity of electronic wrist pedometers. We recommend the following precautions for circumferential pedometer use:

- Do not wear the wrist pedometer too tightly.
- Remove the pedometer during periods of prolonged typing.
- Avoid concurrent increased hand activities.
- Should symptoms persist, stop wearing the wrist pedometer or any other inflexible circumferential wristband or bracelet.
- Consider using a non-circumferential wrist pedometer or a non-wrist pedometer as an alternative.

## Keypoints

- The patient’s symptoms, consistent with early left CTS, were possibly caused by the increased repetitive keyboarding, exacerbated by the pedometer’s compression.
- Wearing a wrist pedometer seems to have played a role in

the development of numbness in the median distribution and discomfort in a wrist susceptible to median nerve irritation from increased repetitive motion.

- This case builds on existing knowledge implicating circumferential structures worn around the wrist in CTS (Wertsch and Melvin, 1982) and is timely given increased implementation of electronic health records in the context of “meaningful use” incentives and the recent rise in the popularity of electronic wrist pedometers.
- Circumferential pedometer users should be aware of several precautions that can help avoid any related complications.

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