■ Multimedia teaching material

Epileptic Disord 2021; 23 (2): 432-434

Epileptic Disorders

Use of fitness trackers to identify and document epileptic seizures

Sándor Beniczky[1], Guido Rubboli[2]

[1] Department of Clinical Neurophysiology, Danish Epilepsy Centre, Dianalund and Aarhus University Hospital, Aarhus, Denmark; Department of Clinical Medicine, Aarhus University, Aarhus, Denmark

[2] Department of Neurology, Danish Epilepsy Centre, Dianalund and Copenhagen University, Copenhagen, Denmark

Received September 22, 2020; Accepted: December 19, 2020

Key words: consumer wearables; fitness tracker; epilepsy; seizure documentation

We are currently in an age of rapid digital integration, with smartphones and consumer wearable devices, such as smartwatches that have become a part of everyday life [1]. Validated algorithms for detecting tonic-clonic seizures are available on specific wearable devices [2]. However, the general functions on smart devices can provide useful information for diagnosis and management of patients with epilepsy. Home videos, recorded with smartphones, help diagnose seizures [3] and improve seizure classification, compared to witnessed seizure descriptions [4]. Consumer wearable devices, such as fitness trackers are widely used. Detailed information can be retrieved about the recorded biosignals (ECG, respiration rate) as well as the map of the route, distance and speed, using the built-in GPS (global positioning system) function.

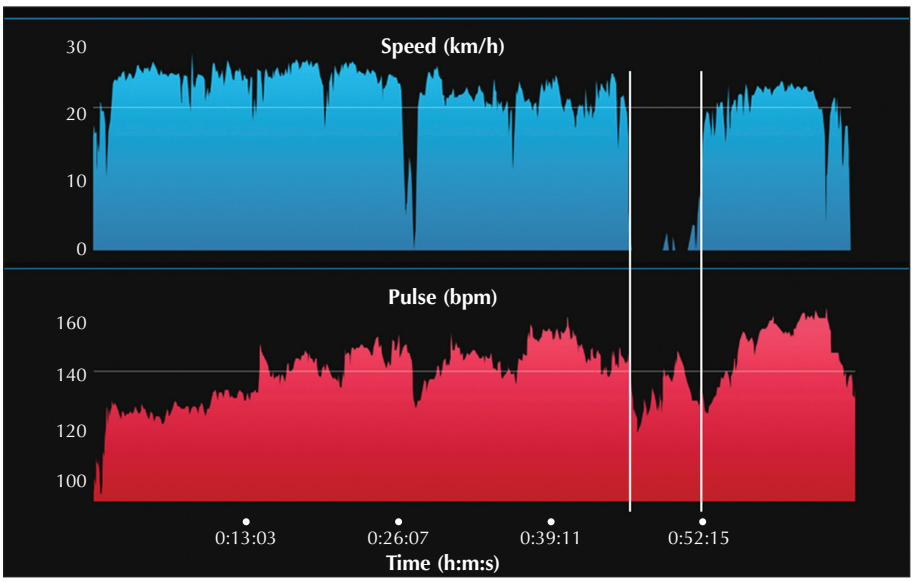
Here we illustrate the potential application of fitness trackers in the management of epilepsy, with the case of a patient who identified and documented an otherwise unnoticed seizure, using a smart cycling device. This 27-year-old, right-handed man suffered from drug-resistant focal epilepsy since the age of 21 years. Due to bilateral independent temporal foci, with normal MRI, epilepsy surgery was not an option. Seizure semiology was characterized by a brief aura ("dizziness" for about 5-10 seconds) followed by loss of consciousness without any overt motor phenomena. Duration of the focal impaired awareness seizures was 3-4 minutes and the post-ictal phase could last up to 15 minutes. The patient was on treatment with levetiracetam (4,000 mg/day), lacosamide (500 mg/day) and clobazam (10 mg/day). He has around 10 focal impaired awareness seizure per month and 1-2 focal-to-bilateral-tonic-clonic seizures per year.

The patient used a smartwatch fitness tracker (Garmin) which monitors heart rate and tracks the movement of the patient on the map, via GPS. After a bicycle tour, the patient retrieved the data from the smart device and noted a period lasting for six minutes, in which he stopped cycling (*figure 1*). The patient was amnestic for that period, and the recordings suggested that he had had a seizure. The heart rate decreased when he stopped cycling (*figure 1*), and increased abruptly without associated physical exercise. The track map showed that he was chaotically walking around, without any purpose, before resuming cycling in the correct direction (*figure 2*).

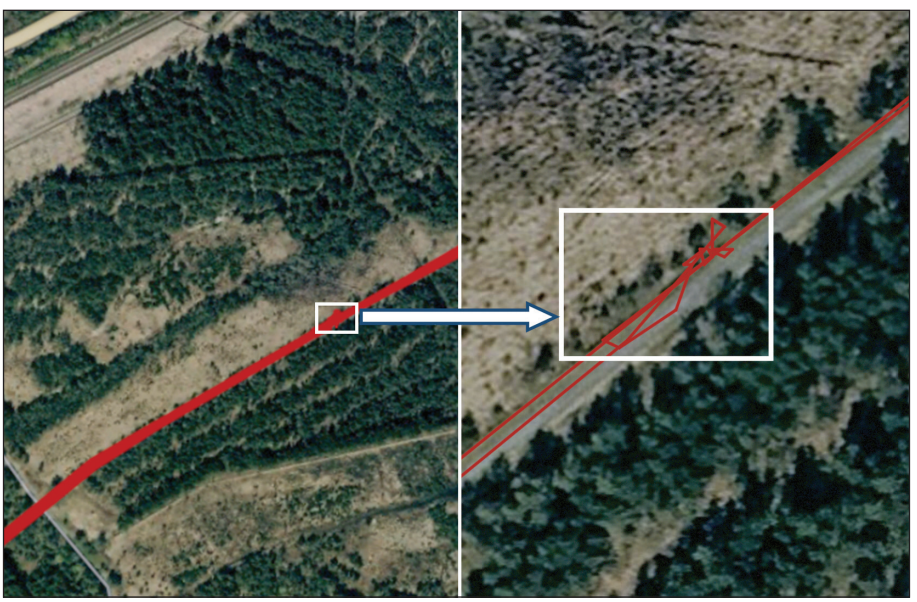
Patients aimlessly wandering around, with relatively coordinated movements during epileptic seizures and status epilepticus have been described since the 19th century [5]. The patients have retrograde amnesia for the experience and the phenomenon is described

• **Correspondence:**
Sándor Beniczky
Danish Epilepsy Centre -
Clinical Neurophysiology,
Visbys Allé 5 , Dianalund 4293
Denmark
<sbz@filadelfia.dk>

doi:10.1684/epd.2021.1271



■ **Figure 1.** Recording of the speed (upper trace) and of the heart rate (lower trace) by the fitness tracker, during a bicycle tour. Note the seizure period marked by the white vertical lines.



■ **Figure 2.** Map retrieved from the fitness tracker. The panel to the right is a close-up of the region of interest. The area within the white box shows the position of the patient during the seizure period (between start and stop as marked in *figure 1*).

as poriomania [6]. The wearable tracker provides an objective documentation of this. It shows that patients can resume complex, well-integrated motor activities after seizures. Without the information retrieved from the tracker, the seizure would have remained unnoticed.

As smart wearable devices become commonly used, we encourage physicians managing people with epilepsy, during history taking, to ask questions related to data retrieved from such devices, as these may provide valuable diagnostic information. ■

Supplementary data.
Summary didactic slides are available on the www.epilepticdisorders.com website.

Disclosures.
SB served as scientific consultant for Brain Sentinel and Epihunter. GR does not report any conflicts of interest related to this work.

References

1. Massoomi MR, Handberg EM. Increasing and evolving role of smart devices in modern medicine. *Eur Cardiol* 2019; 14: 181-6.

2. Beniczky S, Jeppesen J. Non-electroencephalography-based seizure detection. *Curr Opin Neurol* 2019; 32: 198-204.

3. Tatum WO, Hirsch LJ, Gelfand MA, Acton EK, LaFrance WC Jr, Duckrow RB, *et al*. OSmartViE Investigators. Assessment of the Predictive Value of Outpatient Smartphone Videos for Diagnosis of Epileptic Seizures. *JAMA Neurol* 2020; 77: 593-600.

4. Beniczky SA, Fogarasi A, Neufeld M, Andersen NB, Wolf P, van Emde Boas W, *et al*. Seizure semiology inferred from clinical descriptions and from video recordings. How accurate are they? *Epilepsy Behav* 2012; 24(2): 213-5.

5. Charcot JM. *Ambulatory automatisms: a diagnosis of epilepsy. Charcot the clinician: the Tuesday lessons*. New York: Raven Press, 1888, p. 26-55.

6. Mayeux R, Alexander MP, Benson DF, Brandt J, Rosen J. Poriomania. *Neurology* 1979; 29: 1616 -9.

TEST YOURSELF

(1) What valuable information can be recorded using smart wearable devices that can help the diagnosis of epilepsy?
A. Home videos with seizures
B. Changes in heart rate
C. Movement of the patients tracked on a map

(2) In the case presented here, what information helped to identify the seizure?
A. Video of the seizure
B. Changes in heart rate
C. Movement of the patients tracked on the map

Note: Reading the manuscript provides an answer to all questions. Correct answers may be accessed on the website, www.epilepticdisorders.com, under the section "The EpiCentre".