



CASE REPORT

# Epileptic seizures triggered by the use of a powered toothbrush

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## KEYWORDS

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## Summary

**Background:** Reflex epilepsy is characterized by seizures that are triggered in response to a specific stimulus and tooth-brushing epilepsy is an extremely rare form of reflex epilepsy in which the seizures are mainly induced by the act of tooth brushing. In this report, we describe an epilepsy patient whose seizures were exclusively triggered by the use of a powered toothbrush.

**Methods and results:** A 31-year old female had been treated for partial epilepsy of left temporal or frontal lobe for 20 years and she did not have seizures for the last 3 years. However, she experienced periods of auras, partial complex seizures, and nocturnal generalized seizures after she started using a powered toothbrush. The interictal electroencephalography revealed slow wave paroxysm over the left temporal or frontal lobe.

**Conclusions:** This case report is, to our knowledge, the first report of reflex epilepsy in which the seizures were triggered by the use of a powered toothbrush. Possible mechanisms to explain the novel type of this rare disorder are discussed.

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## Introduction

Reflex epilepsy is a very rare condition in which the seizures are triggered by an external stimulus or by an internal mental process.<sup>1</sup> Some causes include visual stimuli<sup>1,2</sup> such as flickering lights in television and electronic screen games or complex visual patterns; somatosensory stimuli<sup>1,3</sup> such as touching or

rubbing certain parts of the body; proprioceptive stimuli<sup>1,2,4</sup> such as walking or movement of a limb and some other complex stimuli such as reading, eating, smelling, hearing certain kind of music and even thinking of a previous trigger. Tooth-brushing epilepsy is an extremely rare form of reflex epilepsy in which the seizures are mainly induced by the act of tooth brushing. To our knowledge, there are only six reported cases of tooth-brushing epilepsy.<sup>3–8</sup> In these cases, the seizures were mainly associated with prolonged (more than 10 min) and vigorous tooth brushing with manual brushes. Recently

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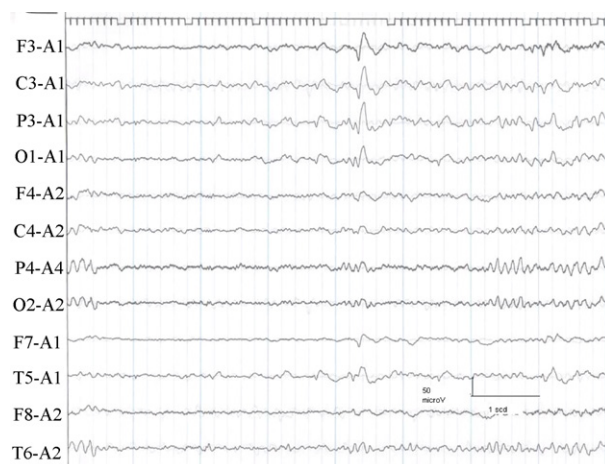
Navarro et al.<sup>8</sup> has presented an epileptic patient whose seizures were induced not only by toothbrushing, but also by thinking about or seeing a toothbrush. In this report, we describe an epilepsy patient whose seizures were exclusively triggered by the use of a powered toothbrush.

## Case report

The patient was a 31-year old female who had been treated for left temporal or frontal lobe epilepsy for 20 years. Her medical history included partial complex seizures after auras at 11 years of age. Auras were characterized with epigastric pain or tenderness with lack of appetite and sometimes with sense of atypical merriment or mirth. This aura often progressed to motor arrest with staring and a feeling of disorientation and losing consciousness with vocal automatism or inability to speak. Post-ictal symptoms included headache, inability to concentrate and sometimes confusion and sleepiness. These seizures were followed by a generalized tonic clonic seizure after a few months. Her seizure frequency increased during the menstrual period. She did not have a history of familial epilepsy, febrile convulsion or head trauma in the infancy. After the use of carbamazepine (600 mg/day), the frequency of her seizures decreased to 3 or 4 partial complex seizures per year and one or two nocturnal generalized seizure per 2 years. Since she had diplopia when the dosage of carbamazepine was increased to 800 mg/day, the dosage was again reduced to 600 mg/day with the addition of vigabatrin (500 mg/day) when she was 26 years old. However, her seizure frequency had increased during this period and vigabatrin was replaced with valproic acid (500 mg/day). Her seizures were partially under control with this therapy. Afterwards, carbamazepine was replaced with oxcarbazepine (900 mg/day) and the dosage of valproic acid was increased to 750 mg/day. The seizures were totally controlled with this regimen and she did not suffer from any seizures for 3 years.

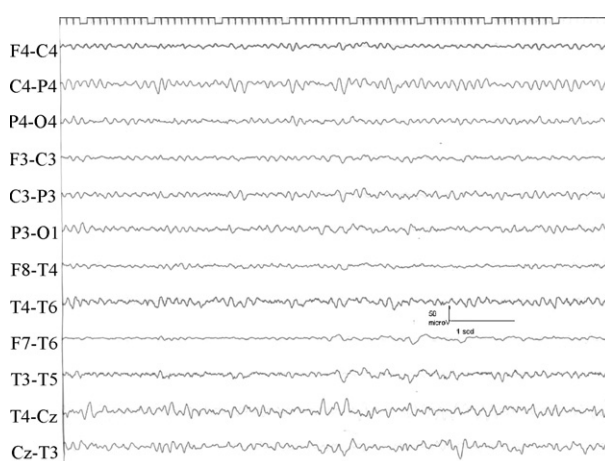
The patient also regularly visited the department of periodontology for 6 years, as she was very concerned about her oral health. She was very compliant and attended her recall visits every 6 months. She maintained excellent oral hygiene using a manual toothbrush three times a day and flossing at least once a day. She did not have any chronic dental or periodontal lesions and she received routine dental prophylaxis procedures at the recall visits.

After her last recall visit in September 2005, she started to use a powered toothbrush (Oral-B,



**Figure 1** Isolated sharp wave activity on F3, C3, P3 and T5 electrodes.

model: Professional Care 5000). On the second day of use of the powered toothbrush, she had periods of auras after 10–15 s of the start of toothbrushing. The auras were characterized by a sense of atypical merriment or mirth and abdominal sensation of discomfort, epigastric pain followed by partial complex seizures with loss of consciousness lasting 5–10 s or less than 1 min. As she continued to use the powered toothbrush, the frequency of the seizures increased to 3–4 times a day each following the act of tooth brushing and in addition she had a nocturnal generalized seizure. Upon referral to the neurology department, her physical examination, magnetic resonance imaging scan and routine blood tests were all normal. The interictal electroencephalography revealed, on a normal background, sharp activity on the left lateral frontal-central-temporal and parietal regions (Fig. 1) and slow wave paroxysm on the left anterior–posterior temporal region (Fig. 2). The patient refused to



**Figure 2** Slow wave activity on F7, T3 and T5 electrodes.

perform a provocation test with a powered toothbrush for prolonged video-EEG monitoring.

After she refrained from using the powered toothbrush, her seizures immediately stopped. However, she started to use it again after a month and her seizures started again after an incubation period. She was advised to brush less vigorously with a manual toothbrush and not to use the powered toothbrush. She did not have any further seizures during the 9-month follow up period.

## Discussion

This case report is, to our knowledge, the first report of reflex epilepsy in which the seizures were triggered by the use of a powered toothbrush. Although a direct cause–effect relationship between the presumed offending stimulus and epileptic seizures could not be demonstrated by video-EEG monitoring; as Koutroumanidis et al.<sup>5</sup> suggested; the timing of the seizures in relation to the use of a powered toothbrush, the absence of any other precipitating factors, and the control of the seizures subsequently after discontinuation of the use strongly suggest that brushing with a powered toothbrush is the triggering stimulus for the seizures in our patient. Hypothetically, we have several explanations for this finding. This case can be similar to the previously reported patients with tooth-brushing epilepsy. The periodontal ligament and gingiva are highly innervated with both myelinated and unmyelinated neurons<sup>9</sup> and the seizures of previous cases<sup>3–8</sup> seemed to require excitation of a critical mass of an already hyperexcitable area within the somatosensory cortex. As the seizures of these patients had begun after vigorous and prolonged tooth brushing, the use of a powered toothbrush, which can exert more force on the teeth, might have enhanced the formation of a critical mass of excitation capable of generating clinical seizures.<sup>5</sup> The somatosensory stimuli produced by the powered toothbrush could have created rub epilepsy, which is a form of reflex epilepsy. In this form, long and regular series of tactile contacts such as touching or rubbing certain areas of the body are the most effective means of eliciting a seizure.<sup>6</sup> Although teeth and gingival tissues make up a well circumscribed body region and powered toothbrush could have applied sufficient tactile stimulations to these tissues, Kanemato et al.<sup>6</sup> have shown that the trigger zone in rub epilepsy exists only on one side of the body. However, the seizures of the present and previously reported cases of tooth-brushing epilepsy were triggered by brushing on either side of the mouth and did not occur with

the contact of a specific side or area of mouth. Therefore, this interpretation requires further investigation.

Reflex epilepsy due to vibratory stimuli has also been documented. Martinho Pimenta and Castelo Branco<sup>10</sup> have described a metalworker with vibroacoustic disease (which is a pathology caused by excessive exposure to high intensity noise) who had epileptic seizures when he used vibratory tools common to his profession, such as drills and sanders. Powered toothbrushes may also create similar conditions with vibratory action and acoustic stimuli. In vitro sound tests have shown that powered toothbrushes produce sounds between 40 and 76 dB levels in a range of 28–1600 Hz frequency (i.e. the frequency of bristle motion per second).<sup>11</sup> The powered toothbrush, which had been used by our patient, has the frequencies of 333 Hz for back–forth motion and 126 Hz for right–left motion. It is possible to assume that the vibratory motion, the high pitch sound and the noise of the powered toothbrush might have triggered the epileptic zone in the craniofacial complex in our patient.

The etiology of previous cases suggested that tooth-brushing induced seizures were associated with hyperexcitability of the suprasylvian operculum<sup>5</sup> or with right central temporal region,<sup>4,6,7</sup> left temporal<sup>8</sup> or left superior frontal<sup>5</sup> epileptogenic focus. The EEG findings and clinical data of our patient also suggest a left temporal or frontal epileptic focus.

In conclusion, with the use of a manual soft toothbrush instead of a powered one, and with less vigorous and shorter brushing, the patient had no further seizures. Presumably, the powered toothbrush might have some multi-factorial triggering mechanisms for the seizures in this patient. As reflex epilepsy seizures of many different kinds have been known for centuries, this case provides information of a novel type of this rare disorder.

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