



# EEG Artifacts

# 8

## 8.1 EEG Artifacts

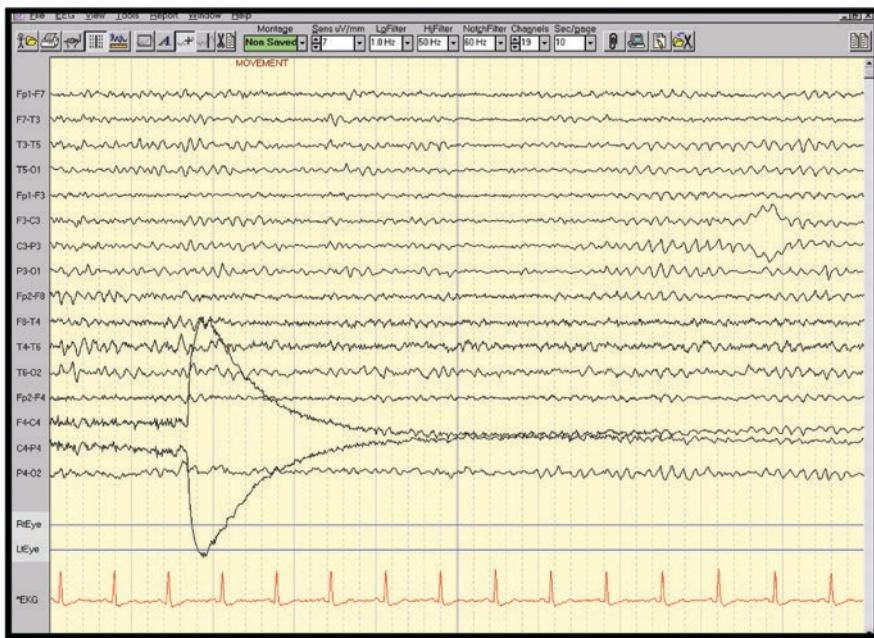
- Signals recorded on the EEG which are not generated by the brain
- Obscure or alter EEG patterns
- Confuse or prevent accurate EEG interpretation
- Non-cerebral artifacts:
  - Show illogical topographic field of distribution
  - Defy principles of localization
- There are two sources of artifacts:
  - *Nonphysiologic* artifact (not from the patient)
  - *Physiologic* artifact (from the patient)

## 8.2 Nonphysiologic Artifact Sources

- Electrodes
- Headbox
- Amplifier
- Cable
- Environment

### 8.2.1 Electrodes and EEG Equipment Artifacts

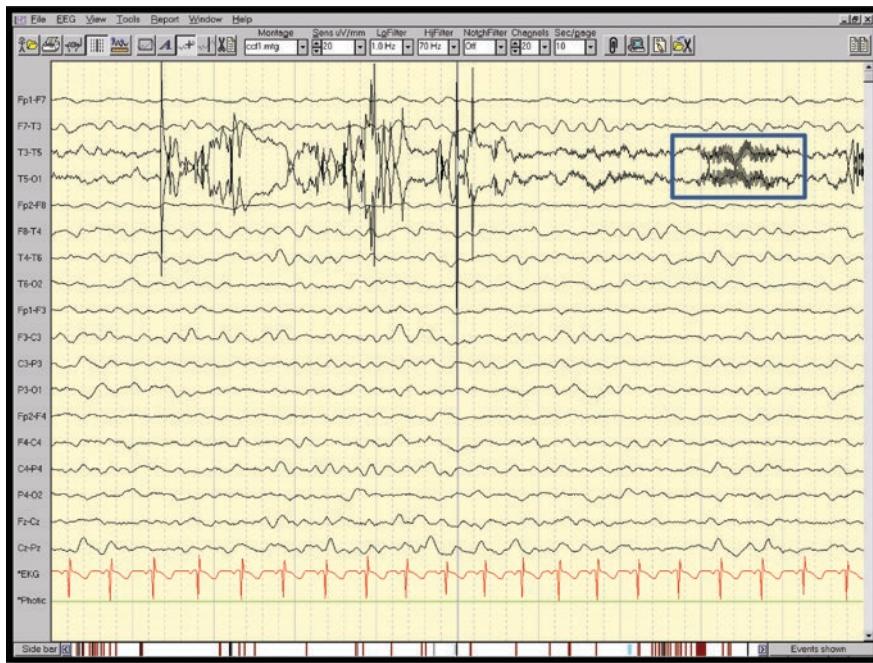
- Any unusual event confined to a single or common electrode is electrode artifact unless proven otherwise
  - Electrode pop or loose electrode (Figs. 8.1, 8.2, and 8.3)
  - Unequal impedance, *dissimilar metals*
    - High voltage, very brief, regional or moderately widespread artifact



**Fig. 8.1** EEG tracing showing electrode pop artifact in C4 electrode



**Fig. 8.2** EEG tracing showing T1 electrode artifact

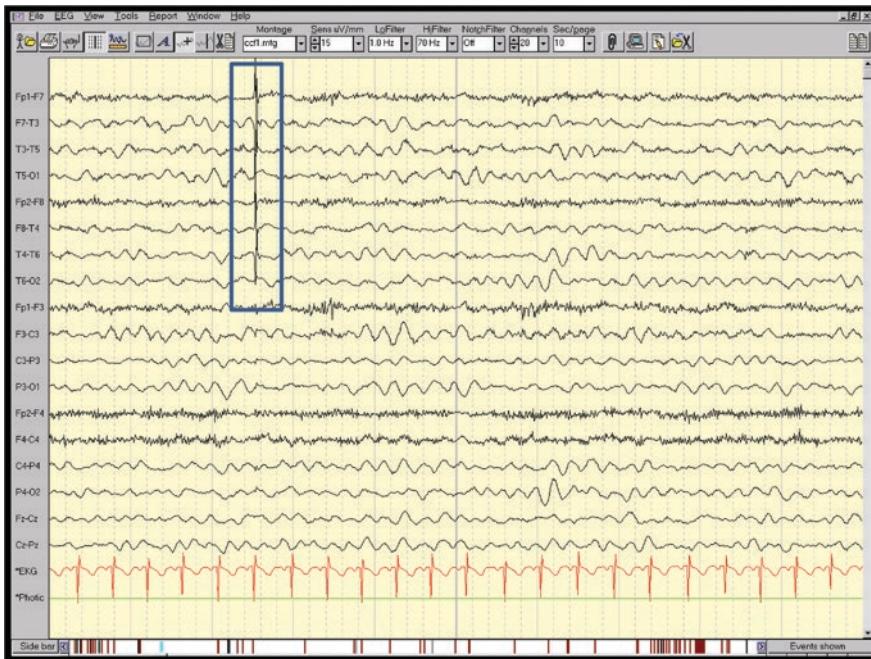


**Fig. 8.3** Loose T5 electrode. Note also the 60 Hz fuzzy artifact shown in the blue box which is the result of high impedance in T5 electrode

- May occur when metals such as *dental fillings* rub against each other during mouth movements (Figs. 8.4 and 8.5)
- More abrupt, higher in voltage, and briefer than muscle artifact
  - 60 Hz artifact
  - Generally results from poor electrode application
  - Due to high impedance electrodes/fuzzy looking (Figs. 8.3 and 8.6)
  - If in all channels may represent a problem with electrical safety
  - Need to ensure electrode impedance is lower than  $5000 \Omega$
  - Use 60 Hz notch filter to remove the artifact
  - If in one or two channels, need to reapply the affected electrode or try new jack
  - If in all channels, reapply ground or reference electrode and turn off lights or other equipment in the room
- Patient touching electrode or wire
- Broken wire/salt bridge/other electrolyte problems



**Fig. 8.4** Another example of more continuous *dissimilar metal artifact* in the right temporal area



**Fig. 8.5** EEG tracing showing *dissimilar metal artifact* related to dental filling



**Fig. 8.6** EEG tracing showing more diffuse 60 Hz artifact. This may present an electrical safety issue and the cause needs to be investigated

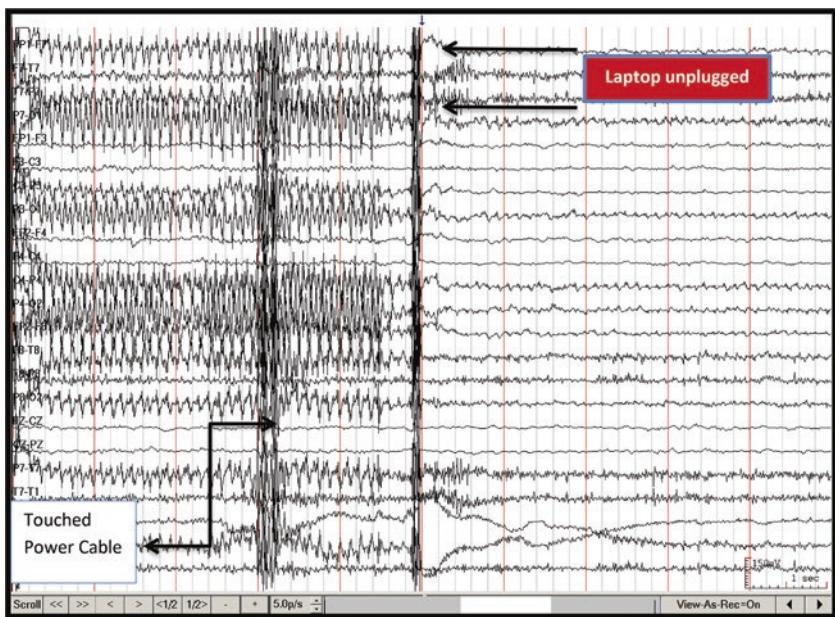
### 8.2.2 Environment-Related Artifacts

- Equipment in the patient's room or attached to the patient:
  - Laptop and electronic devices (Fig. 8.7)
  - IV drip
  - Respirator
  - Phone ringing (Fig. 8.8)
  - Bed/patient movements (Figs. 8.9 and 8.10)

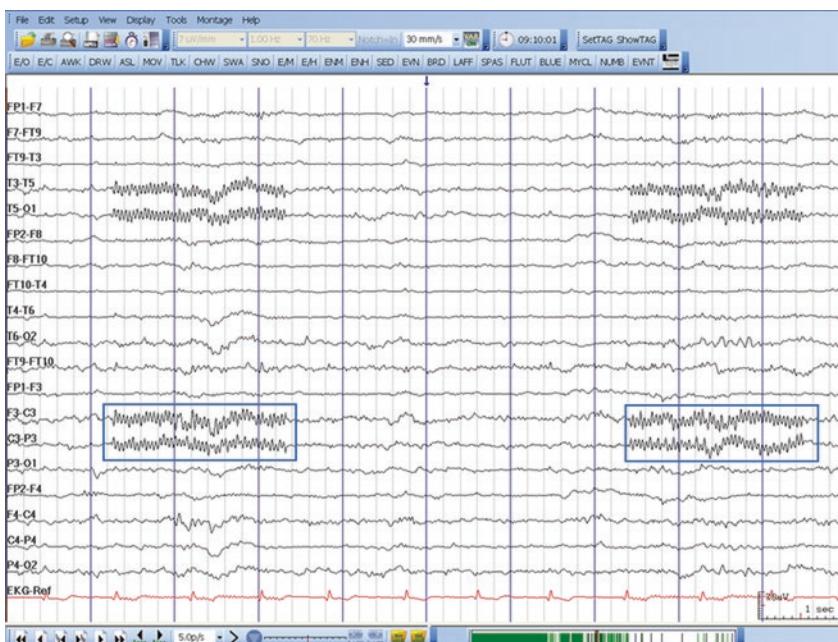
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## 8.3 Physiologic Artifact Sources

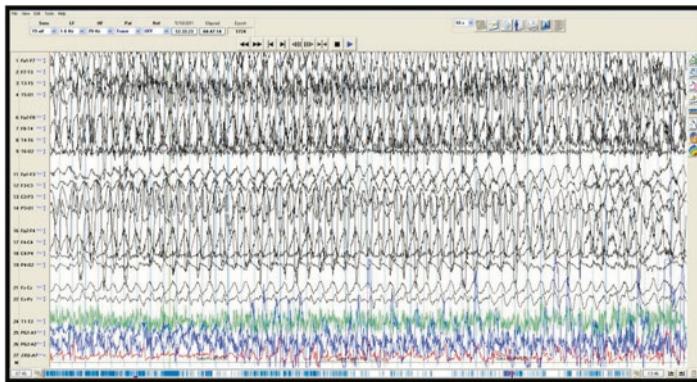
- Artifacts related to the patient
  - EKG/ pulse/pacemaker artifact (Figs. 8.11 and 8.12)
  - Respiration artifact
  - Eye movements artifact
    - Vertical eye movements (Figs. 8.13, 8.14, and 8.15)
    - Horizontal eye movements (Fig. 8.16)
    - Electrical field of the eye: cornea, positive; retina, negative
    - Monitor eye movements with eyelid electrodes
  - Glossokinetic artifact
    - Caused by talking and tongue movements (Figs. 8.17 and 8.18)
    - The tongue has electrical field



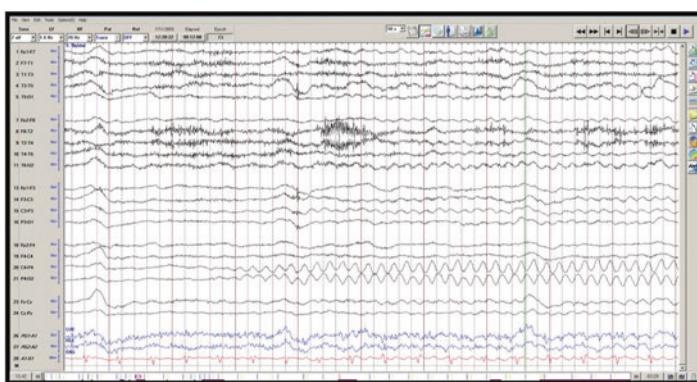
**Fig. 8.7** Artifact created by laptop being plugged in for charging. It resolves with unplugging the laptop



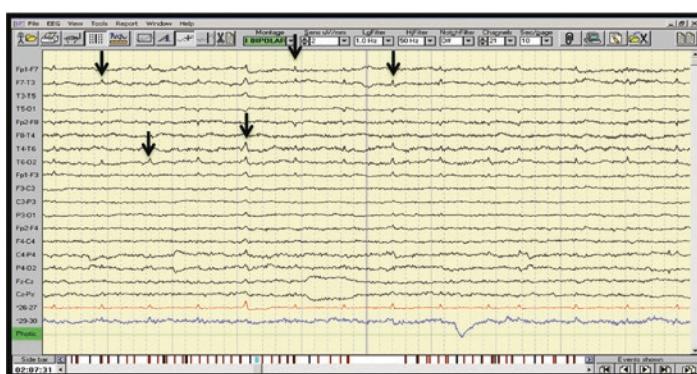
**Fig. 8.8** EEG tracing showing a phone ringing in the room at 3–4 s intervals



**Fig. 8.9** Bed rocking as a result of a non-epileptic side-to-side body jerking event



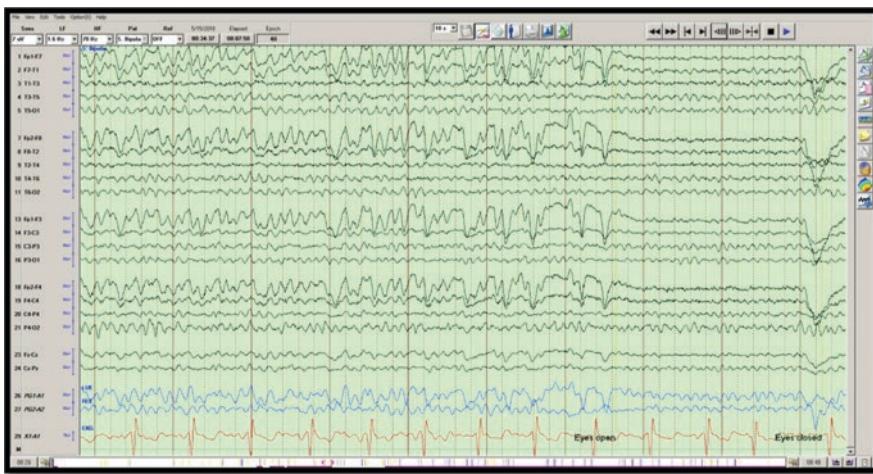
**Fig. 8.10** EEG tracing showing rhythmic artifact in P4 as a result of patient undergoing chest physiotherapy



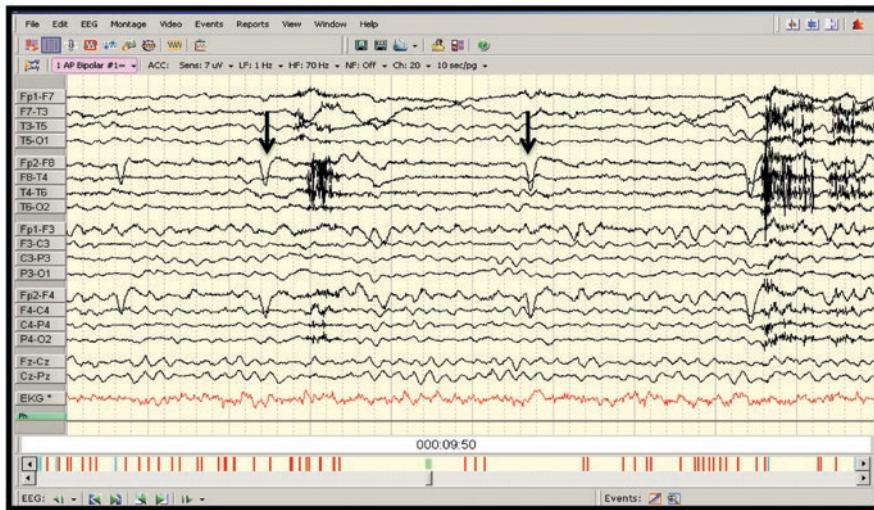
**Fig. 8.11** EEG tracing showing widespread EKG artifact (black arrows) lining up with the peaks of EKG channel (red) in a young, obese man. His short neck facilitated transmission of EKG activity to other electrodes



**Fig. 8.12** EEG tracing showing pulse artifact in C3 and C4 electrodes



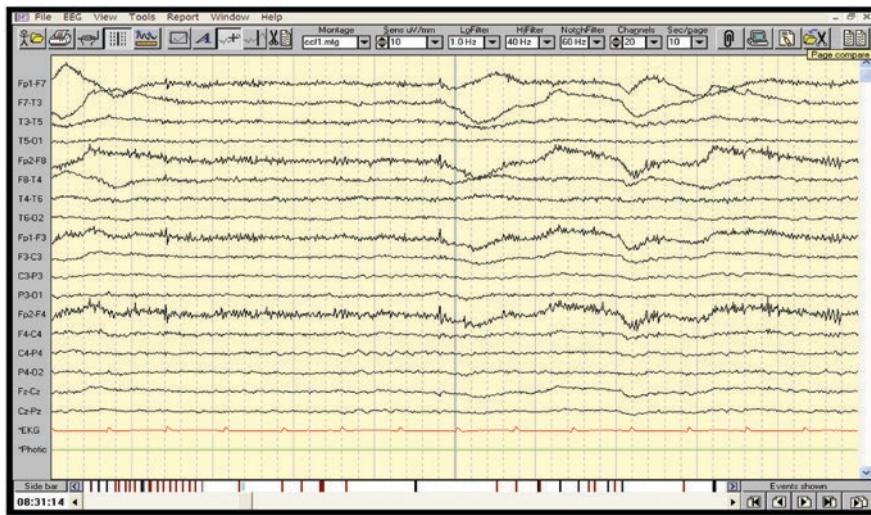
**Fig. 8.13** EEG tracing showing rapid eye fluttering with rhythmic artifact seen maximal in fronto-polar leads



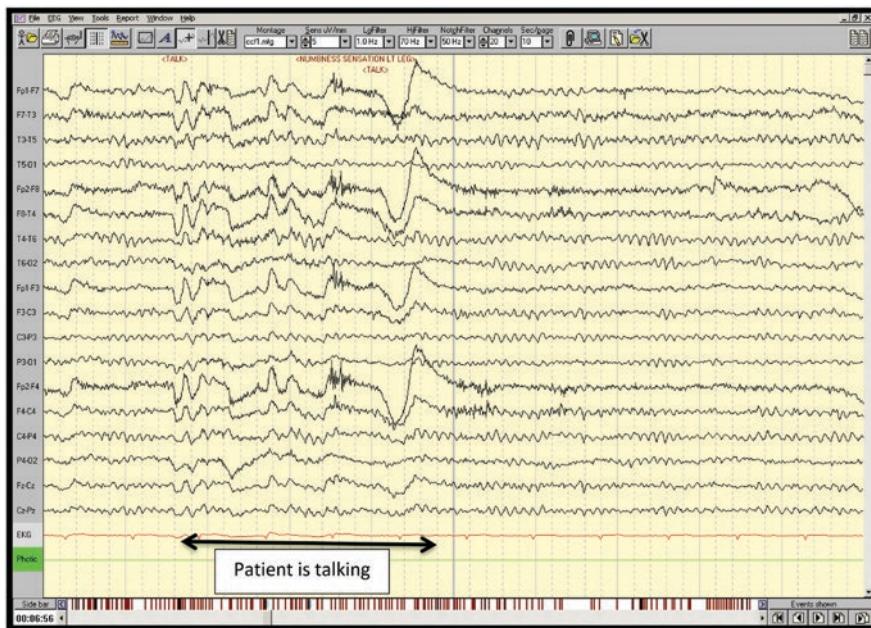
**Fig. 8.14** EEG tracing showing unilateral eye blink on the right (black arrows). Patient has left eye prosthesis



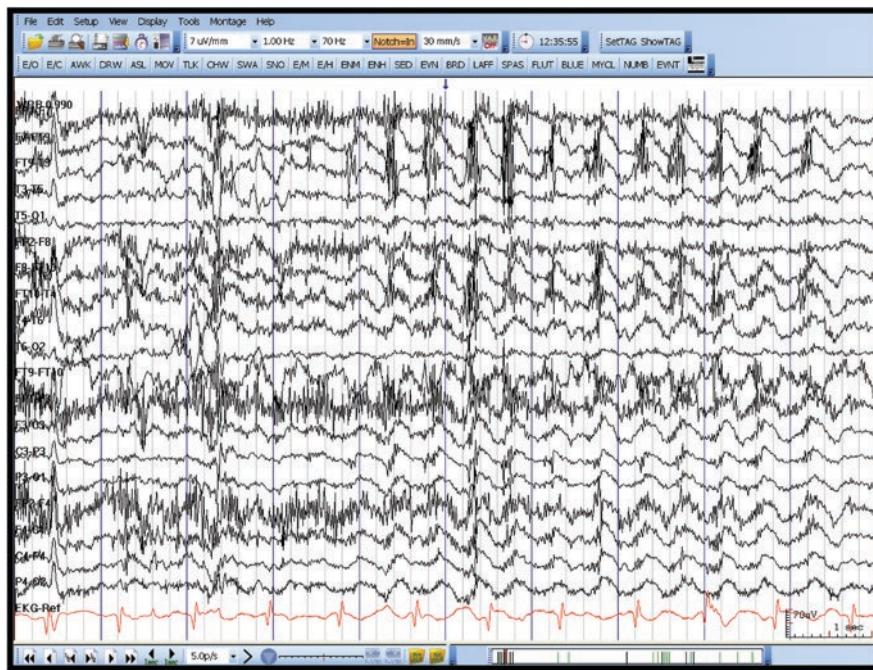
**Fig. 8.15** EEG tracing showing vertical eye movements (black arrows) with patient blinking intermittently seen maximal in fronto-polar leads and confirmed in the eyelid electrodes (blue lines)



**Fig. 8.16** EEG tracing showing lateral eye movement artifact maximal in F7 and F8 electrodes

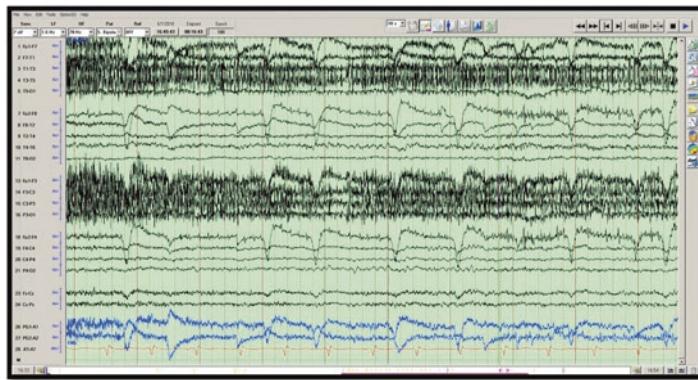


**Fig. 8.17** EEG tracing showing glossokinetic artifact as the patient starts to talk

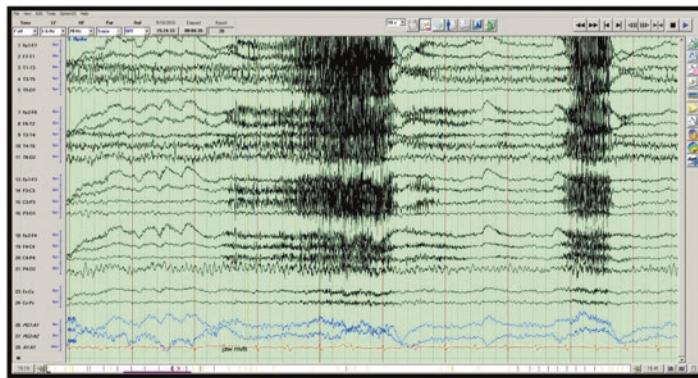


**Fig. 8.18** EEG tracing showing chewing and tongue movements causing a combination of rhythmic myogenic and glossokinetic artifact

- Tip of the tongue, negative; back of the tongue, positive
- Artifact looks like repetitive slow waves in frontal leads (mimics frontal intermittent rhythmic delta activity or FIRDA)
- Having patient say words with “L” or “T” sounds (Tom thumb, Lilt, etc.) will reproduce this artifact
- Myogenic artifact
  - 20–35 Hz EMG, single motor neuron potential (Fig. 8.19)
  - Chewing/swallowing artifact (Figs. 8.18 and 8.20)
  - Lateral rectus muscle twitch artifact (Fig. 8.21)
- Sobbing/hiccupping artifact/sniffling (Fig. 8.22)
- Shudder/shiver/tremor artifact (Fig. 8.23)
- Sweat artifact – slow sway of signal (Fig. 8.24)
  - Galvanic skin response
  - High amplitude, very-low-frequency potentials (0.5–1 Hz)
  - Standard low-frequency filter may reduce this artifact



**Fig. 8.19** EEG tracing showing left hemispheric myogenic artifact due to patient touching the left side of head



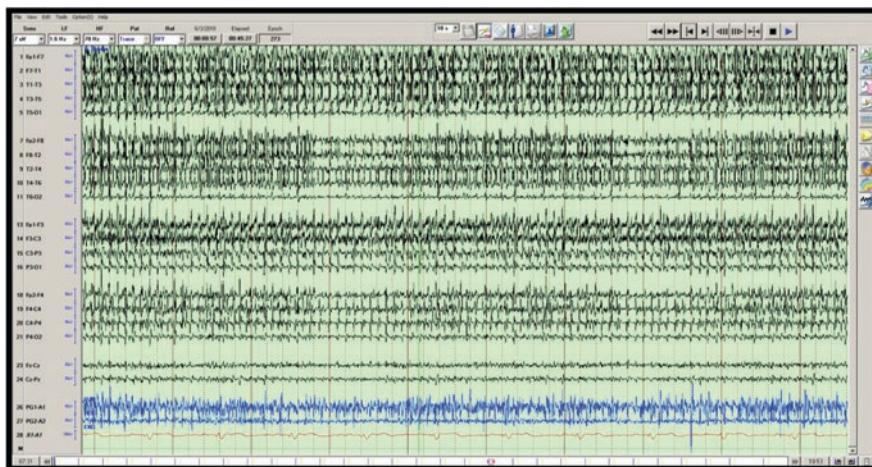
**Fig. 8.20** EEG tracing showing jaw movement followed by swallowing artifact



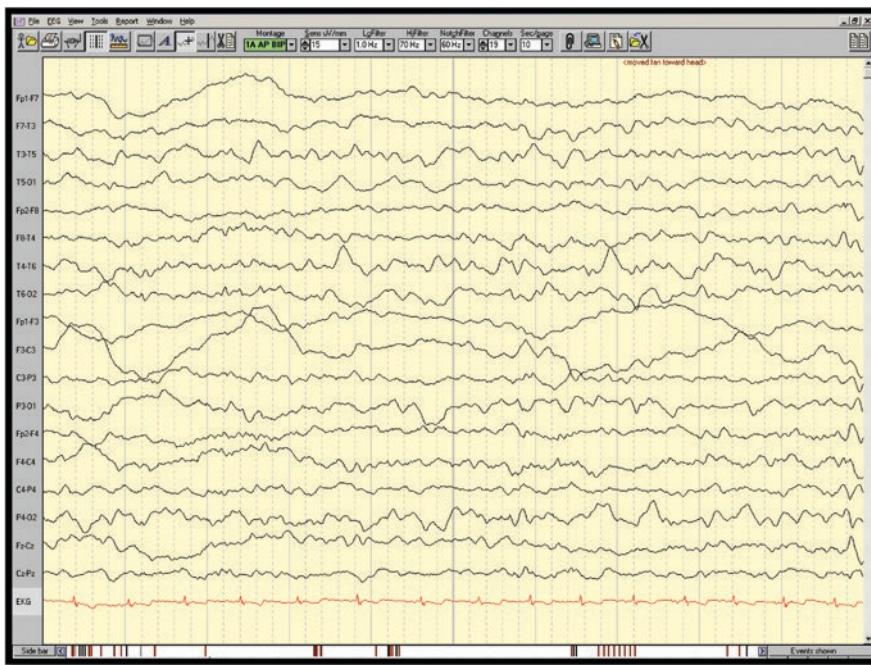
**Fig. 8.21** EEG tracing showing repetitive lateral rectus myogenic spikes (black arrows) in fronto-polar electrodes



**Fig. 8.22** EEG tracing showing repetitive sniffling artifact (black arrows)



**Fig. 8.23** EEG tracing showing generalized shivering artifact in an ICU-hospitalized patient



**Fig. 8.24** EEG tracing in a sweating patient with F3 and F7 showing sway artifact

#### Take-Home Points

- Artifacts are either physiologic (related to patient) or non physiologic (related to environment around the patient)
- Physiologic artifacts include:
  - EKG, pulse, pacemaker, eye movements, myogenic, shivering, sniffling, hiccupping, and glossokinetic and sway artifact due to sweatiness
- Non physiologic artifacts include:
  - Loose electrodes, high impedance electrodes, 60 Hz artifact, bed movements, electronics plugged in the room, and equipment attached to the patient or around the patient
- Recognizing artifacts is important for the technician to try to resolve and for the EEG reader to make accurate interpretation