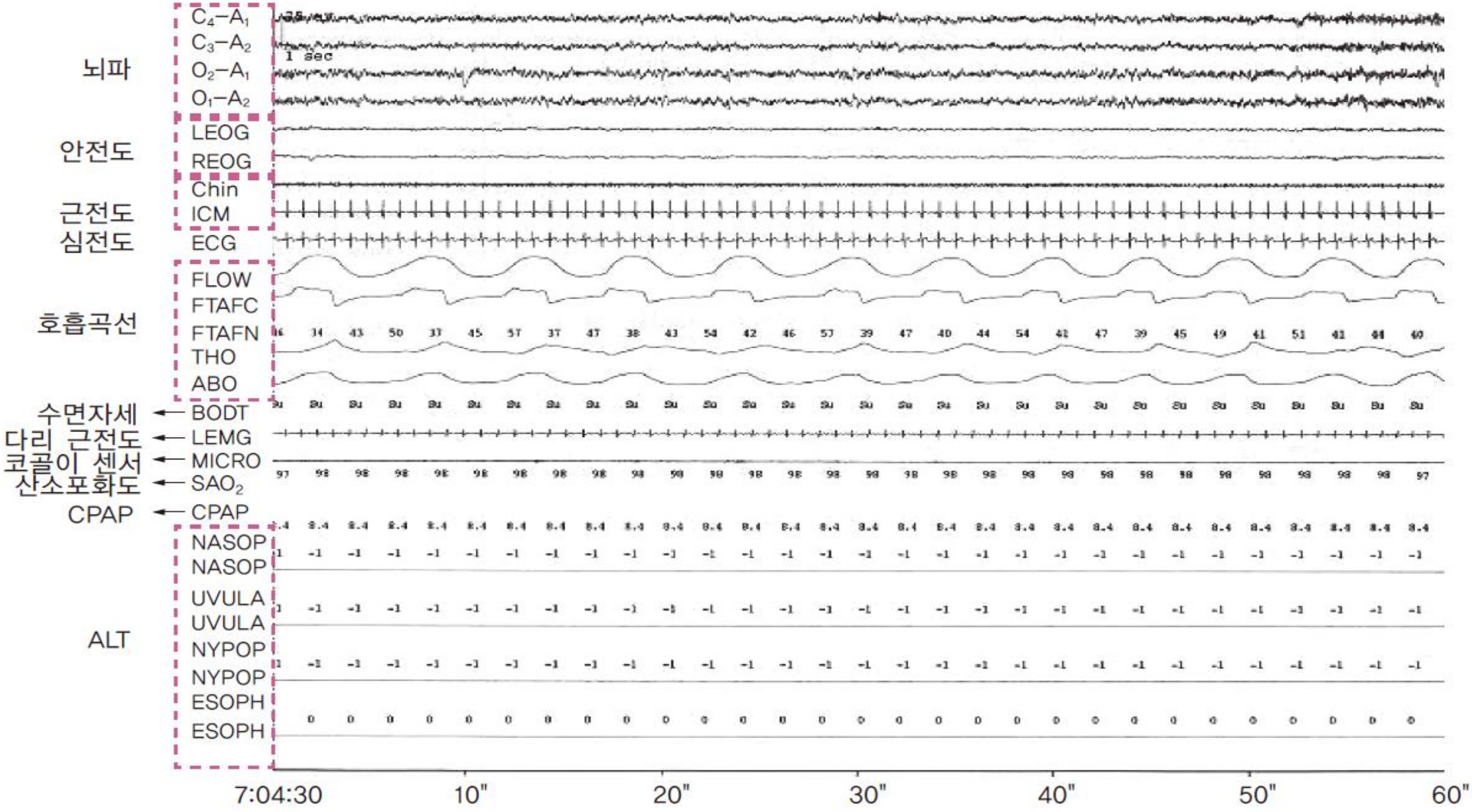
Section 07

수면다원검사
(Overnight polysomnography, PSG)

학습목표

1. 야간 수면다원검사의 임상적 의의를 설명할 수 있다(A).
2. 야간 수면다원검사의 센서종류 및 역할을 이해할 수 있다(A).
3. 수면다원검사의 파형을 이해할 수 있다(A).
4. 야간 수면다원검사의 대상 질환을 설명할 수 있다(A).
5. 수면무호흡증의 종류와 특징을 이해할 수 있다(A).


뇌파
안전도
근전도
심전도
호흡곡선
수면자세
다리 근전도
코골이 센서
산소포화도
CPAP
ALT
C4–A1
C3–A2
O2–A1
O1–A2
LEOG
REOG
Chin
ICM
ECG
FLOW
FTAFC
FTAFN
THO
ABO
BODT
LEMG
MICRO
SAO2
CPAP
NASOP
NASOP
UVULA
UVULA
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1 sec
7:04:30
10"
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50"
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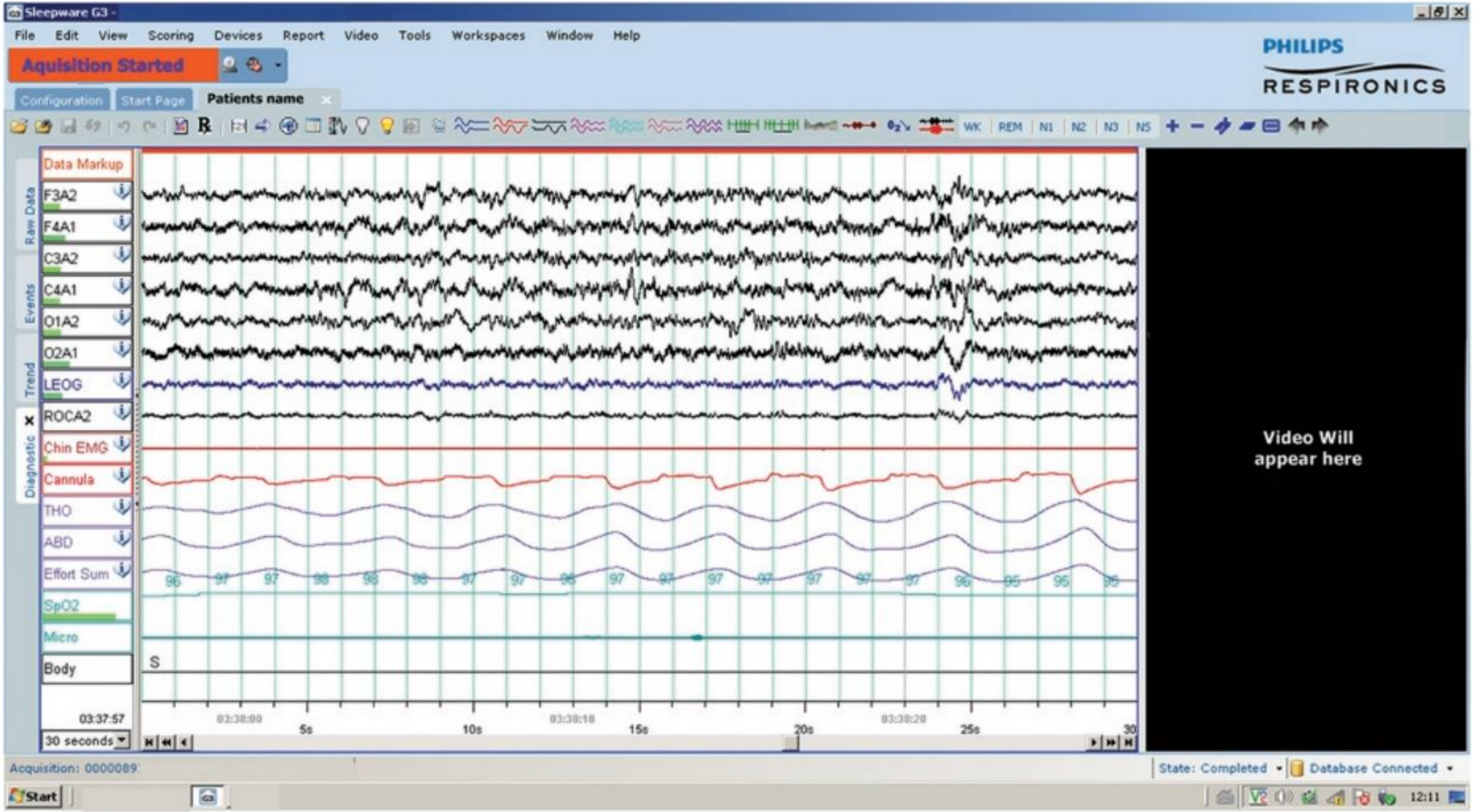


Figure 7.20 This recording page will appear. Start Calibration (Chapter 8).

표 7-1. 수면 polygram의 판정기준(백분율은 % time, *표는 중요 지표)

	Stage W	M T	Stage N_1	Stage N_2	Stage N_3	Stage R
L. EOG		* 				* 
R. EOG		* 				* 
EMG		* 				* 
EEG	*ALPHA ACTIVITY 8~13 Hz  50% ≤ LOW VOLT MIXED FREQ. 	MOVEMENT TENSION  EMG 50% ≤	MIXED FREQUENCY 2~7 Hz  VERTEX SHARP WAVE 	* SPINDLE 12~14 Hz  0.5 sec < * SLOW ACTIVITY 2 Hz≥ 75 μV≤  <20% K-COMPLEX 	SLOW ACTIVITY 2 Hz≥ 75 μV≤  20% ≥	MIXED FREQUENCY 2~7 Hz 

* 미국수면의학회(American Academy of Sleep Medicine, AASM, 2007)에 의해 작성된 수면단계 판정모식도

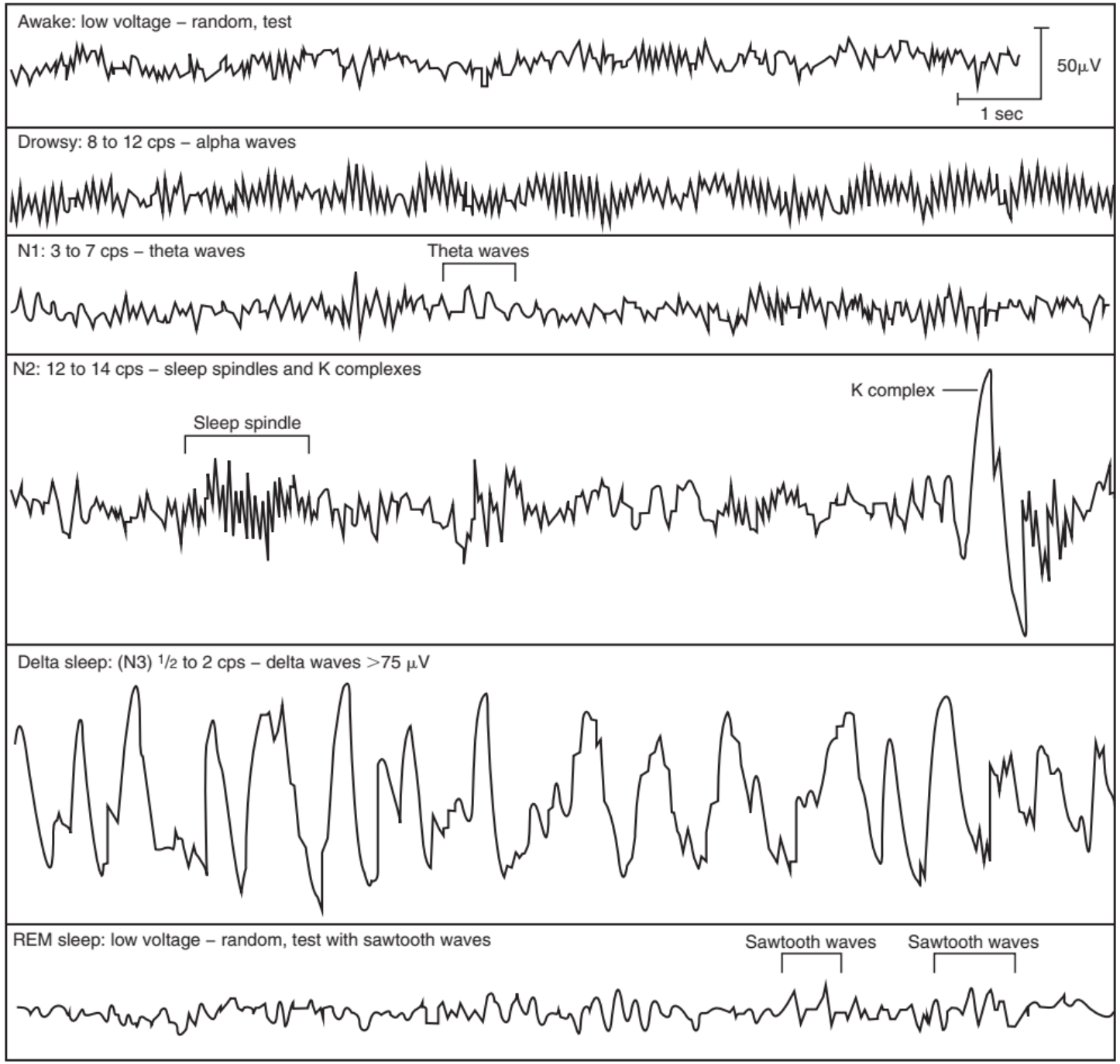


FIGURE 4.2-17. Features of sleep-stage electroencephalogram frequencies. cps, cycles per second.



EEG용 전극



다리근전도 전극



심전도용 전극



micro phone 센서



호흡(oral, nasal)센서



호흡센서



혈중산소포화농도(oximetry)
기계 및 센서



수면자세용 기기 및 센서



지속적 혈압 측정용 기계



(전극 부착)용액 콜로디온



줄자



Omniprep



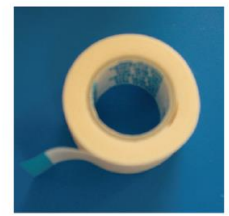
아세톤(콜로디온제거제)



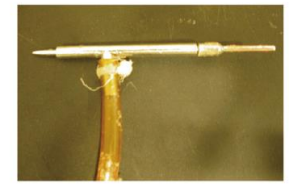
Electrode jelly



Air compressor



Surgical tape



Stylus



Intercom



양면 tape



Paper



CPAP remote controller



Mini electrode board

EEG (수면단계)

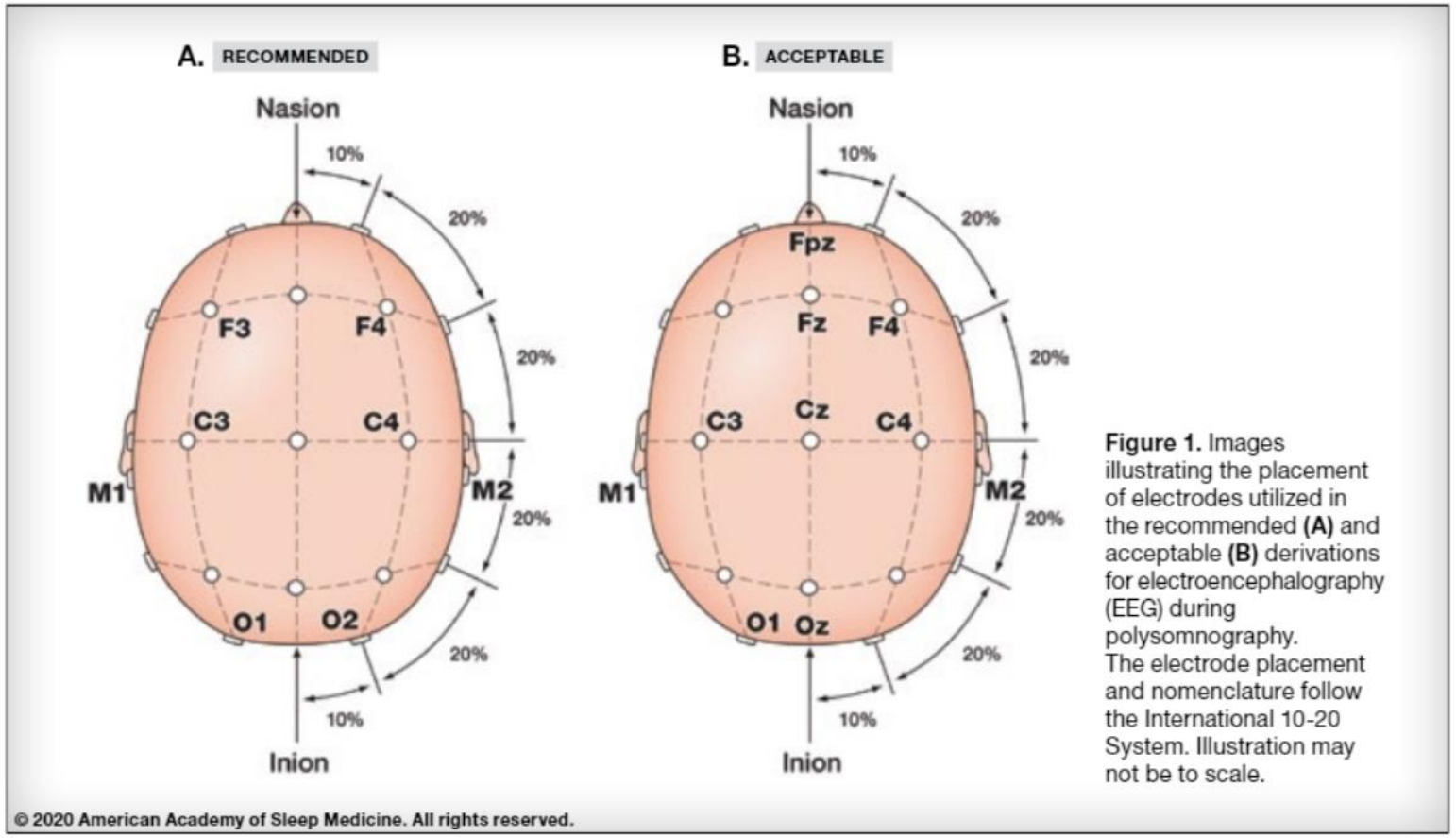


Figure 1. Images illustrating the placement of electrodes utilized in the recommended **(A)** and acceptable **(B)** derivations for electroencephalography (EEG) during polysomnography. The electrode placement and nomenclature follow the International 10-20 System. Illustration may not be to scale.

Note 1. At a minimum, frontal, central, and occipital derivations (3 EEG channels) are required to stage sleep.

Note 2. M1 and M2 refer to the left and right mastoid processes. M1 is the standard reference electrode for recording EEG. If M1 fails during the recording, backup electrodes should be used and referenced to M2.

Note 3. Fz-Cz is not appropriate for measuring the amplitude of frontal activity for determination of slow wave activity. When using the **acceptable** EEG derivations and the **acceptable** EOG derivations (Figure 2), the E1-Fpz derivation should be used to measure frontal slow wave amplitude. Used in this way, Fpz will be the active electrode recording frontal activity and E1 the reference electrode in a referential derivation. When using the **acceptable** EEG derivations and the **recommended** EOG derivations, EEG amplitude to determine slow wave activity should be measured using the C4-M1 derivation (C3-M2 if either C4 or M1 electrodes malfunction). When using the **recommended** EEG derivations and **recommended** EOG derivations, the EEG amplitude is measured using the derivation F4-M1.

EOG (Elcectroocculogarm, 안구운동)

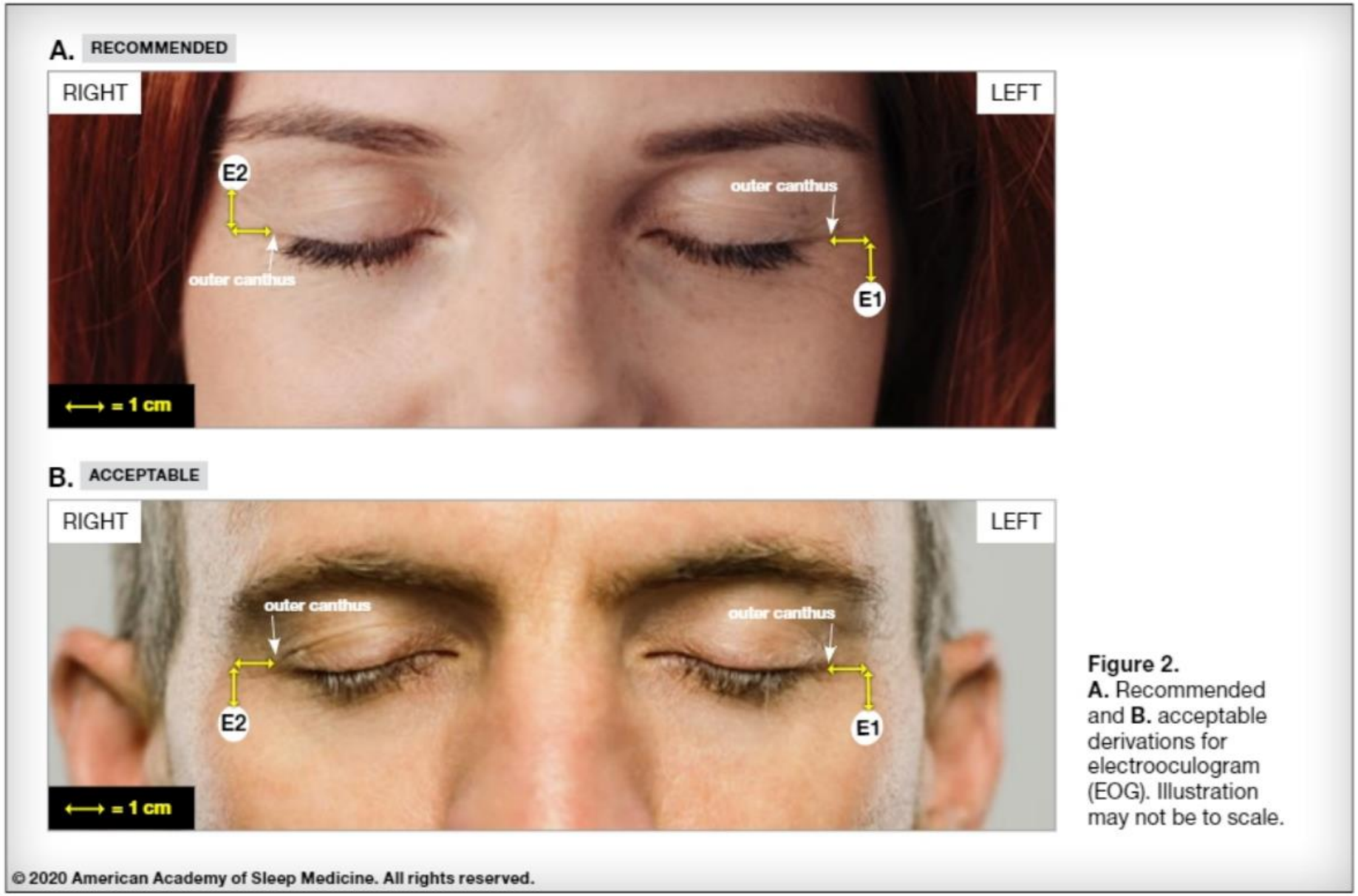


Figure 2.
A. Recommended and **B.** acceptable derivations for electrooculogram (EOG). Illustration may not be to scale.

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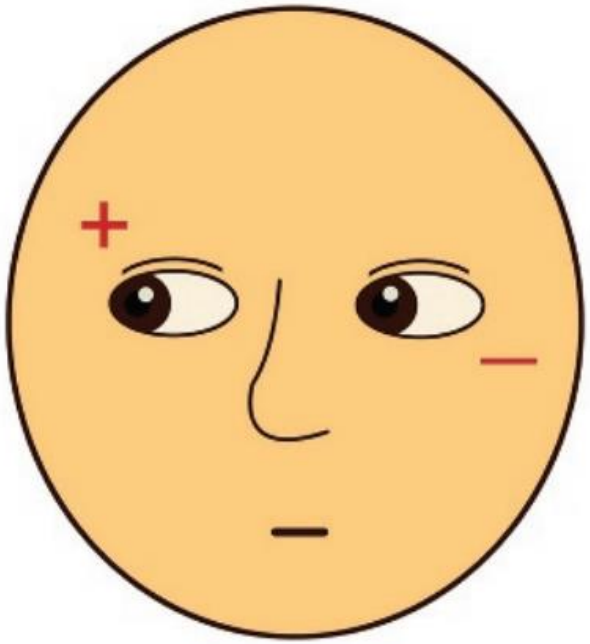


Figure 4.16A Eye movement produce changes in not only EOG electrodes but also frontal electrodes: A: Eye is a dipole, hence its movement produces a deflection in the EOG derivations; Right eye is showing positive deflection as positively charged cornea is moving towards it while left eye shows negative deflection as positively charged arena is moving away from it.

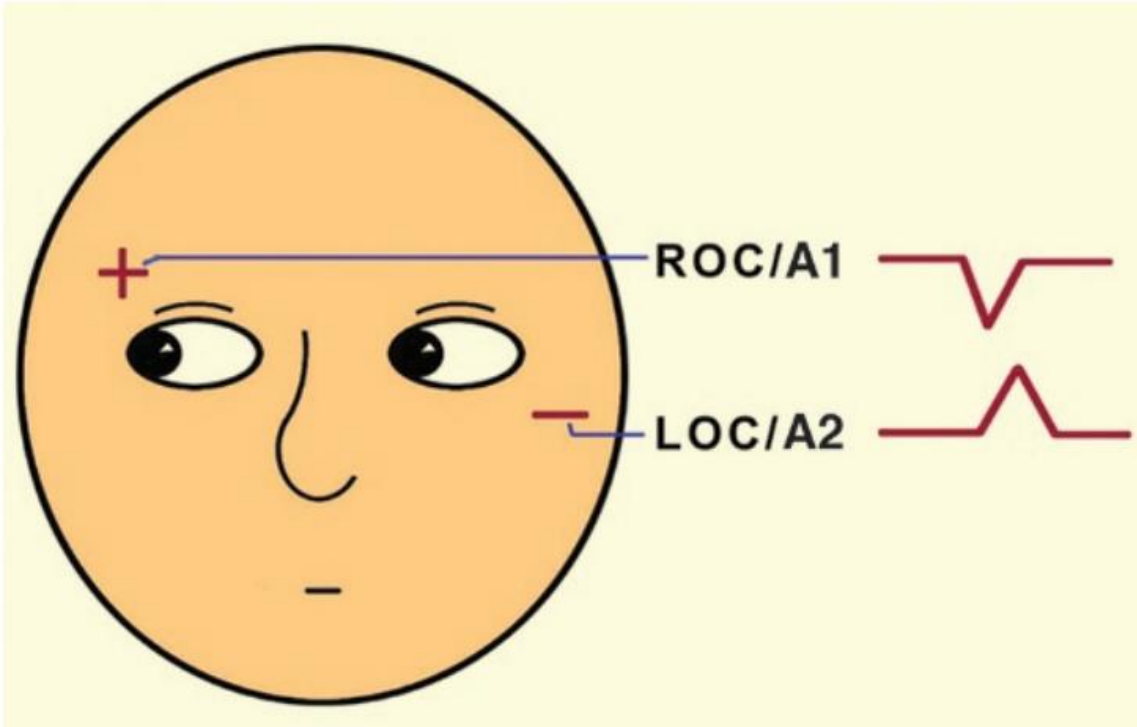


Figure 4.16B Eye is a dipole, hence its movement produces a deflection in the EOG derivations; Right eye is showing positive deflection as positively charged cornea is moving towards it while left eye shows negative deflection as positively charged arena is moving away from it.



Figure 4.17 Rapid eye movements: Fast saccadic movements are seen during REM sleep.

Chin EMG (턱 근전도)

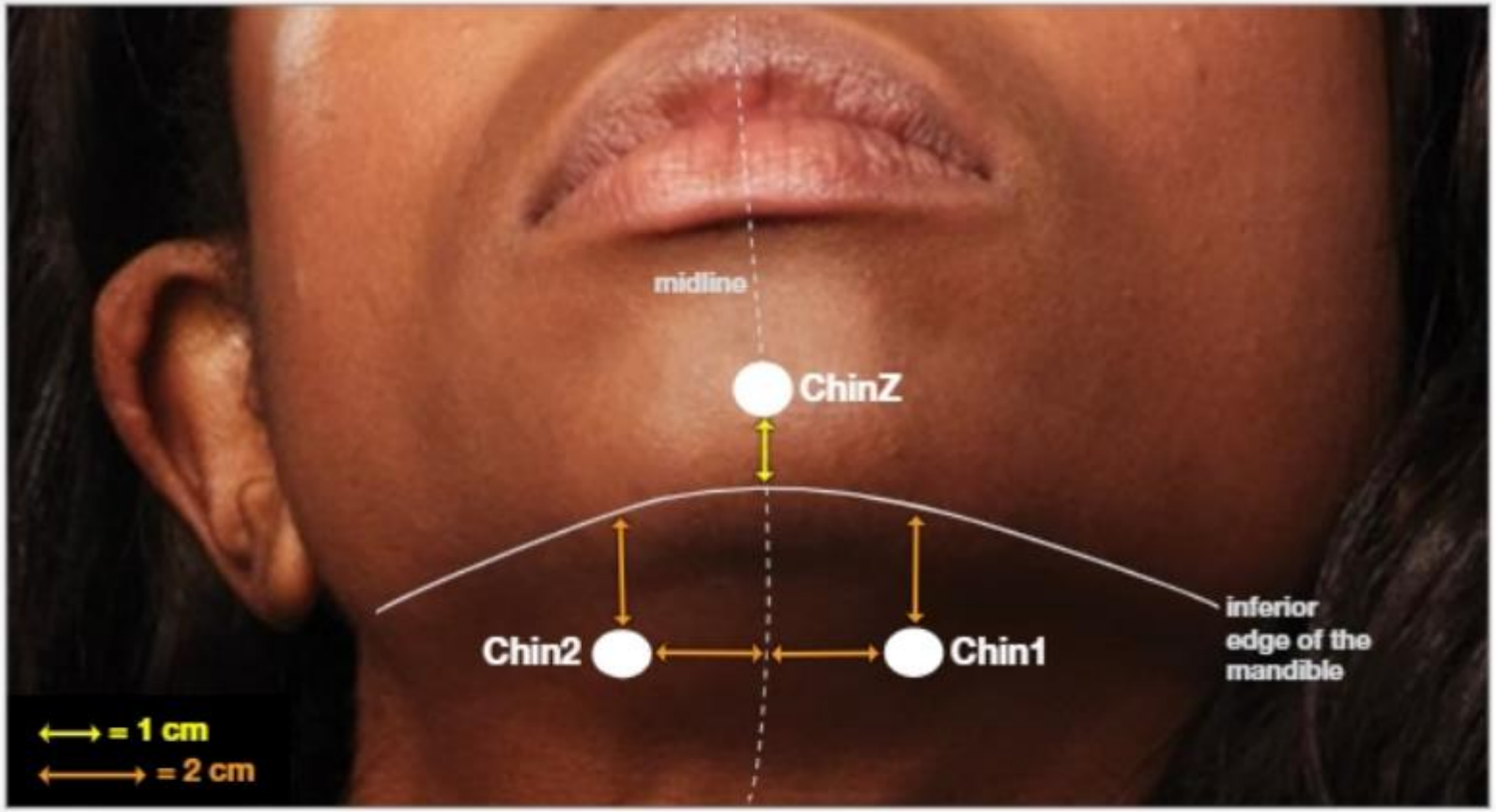
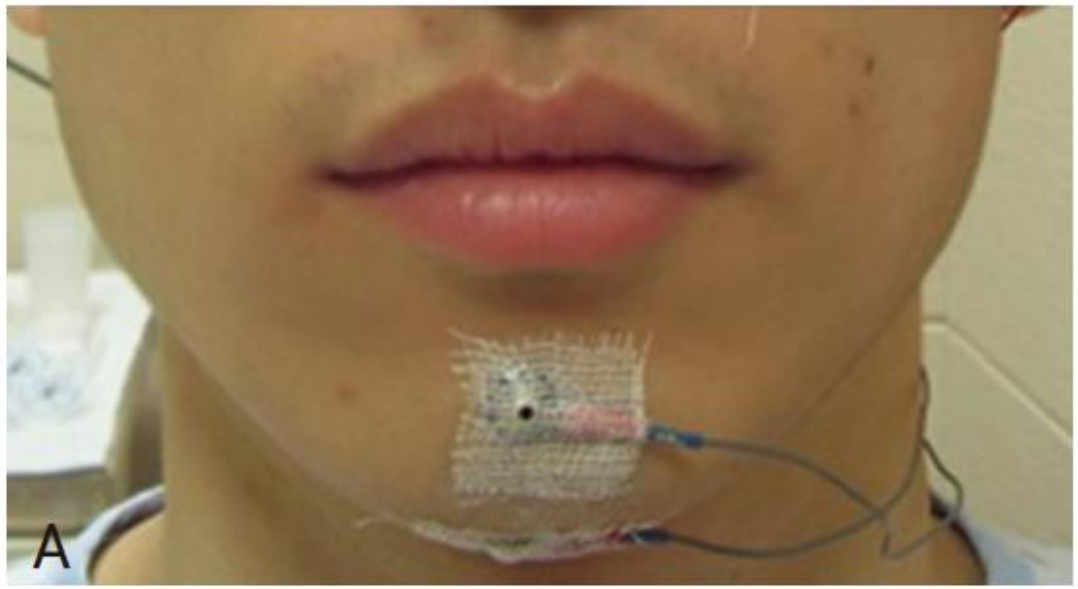


Figure 3. Placement of electrodes on the chin for electromyogram (EMG) recording. Illustration may not be to scale.

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Note 1. If EMG electrode ChinZ (above the mandible) fails during the recording, it should be replaced, if possible. Otherwise, reference electrodes Chin2 and Chin1 (below the mandible) to each other.

근전도 (턱, 다리)





Leg EMG (다리 근전도)



Figure 1. Placement of electrodes on the anterior tibialis muscle for monitoring leg movements. Illustration may not be to scale.

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ECG (심전도)

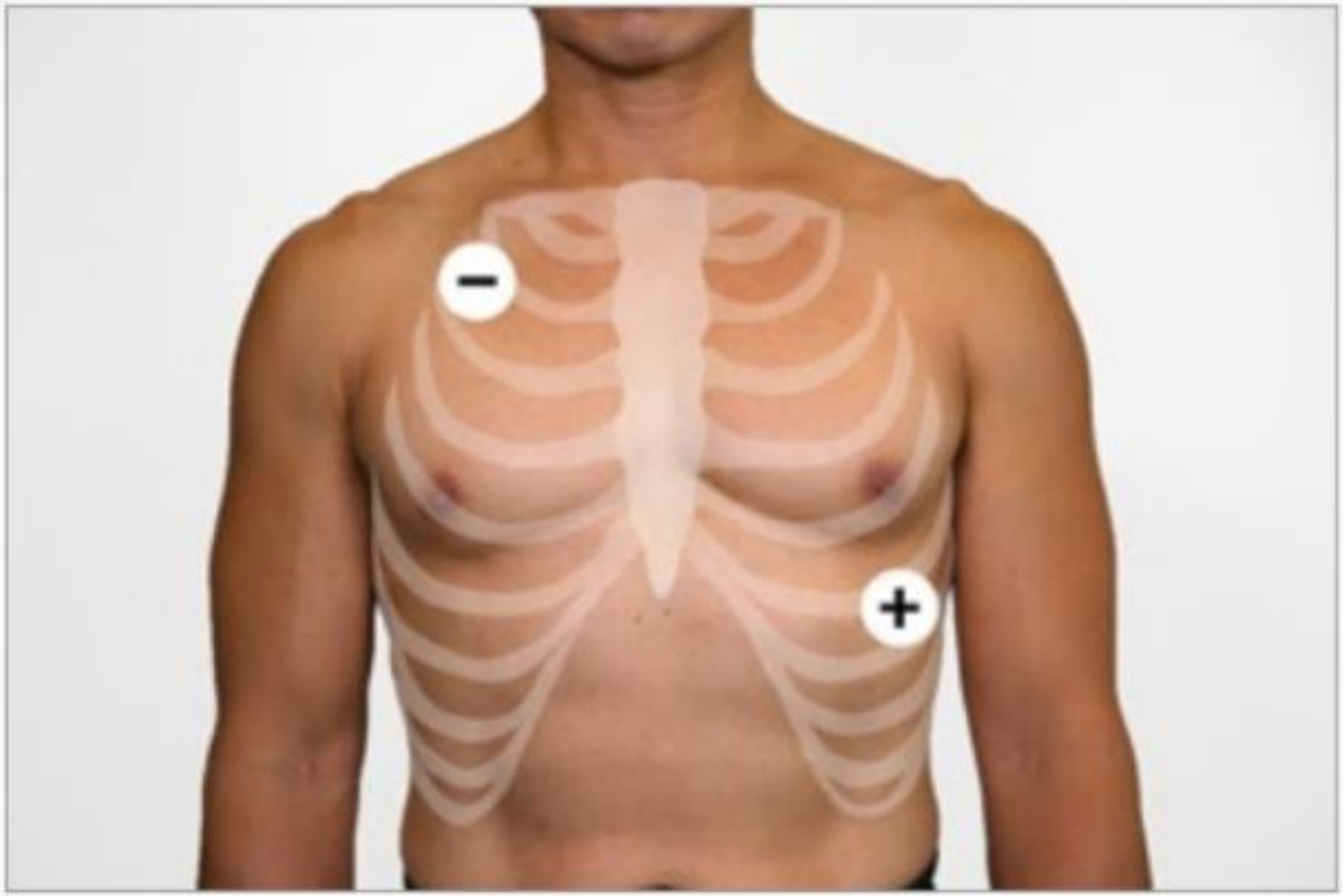


Figure 1.
Diagram of Lead II placement on torso during cardiac recording. Illustration may not be to scale.

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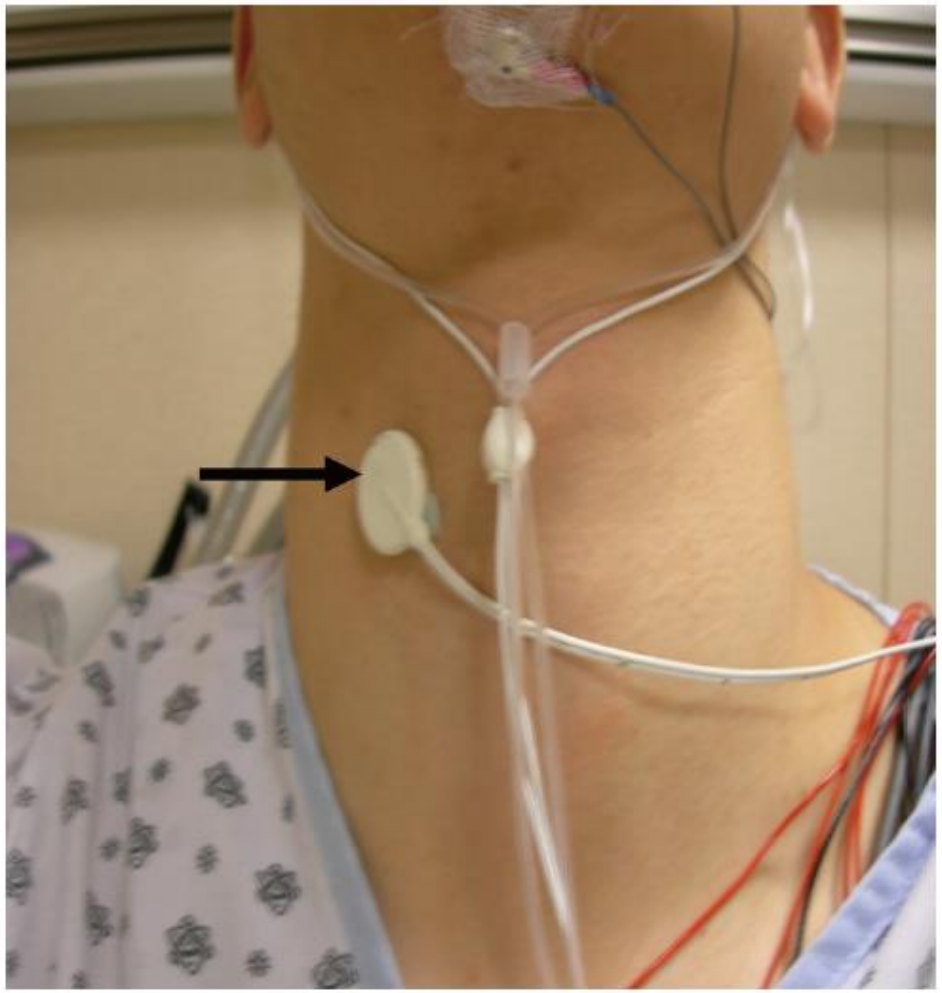
Microphone (Snoring 유무)



마이크로폰 부착한 모습



Microphone 센서



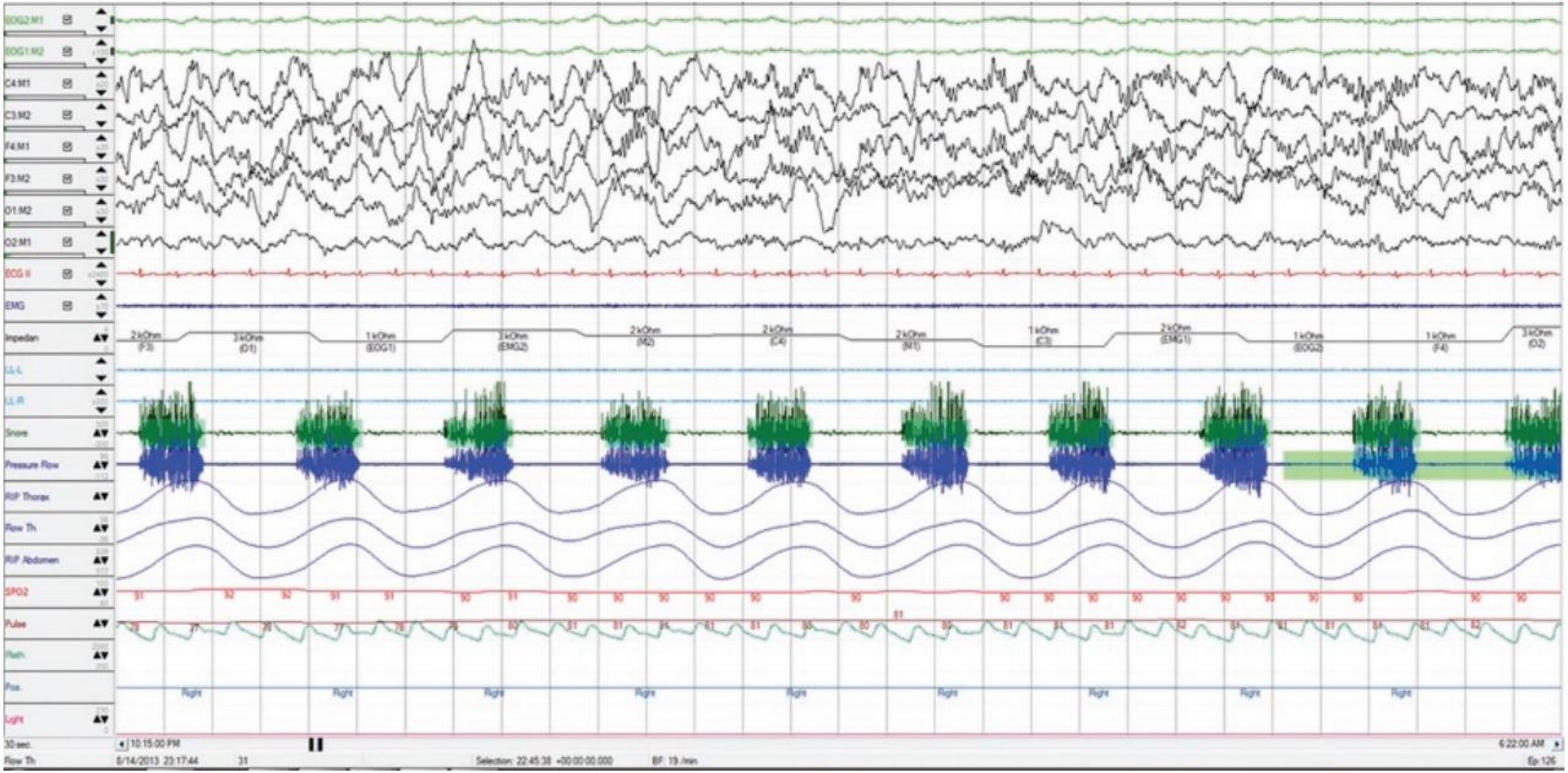
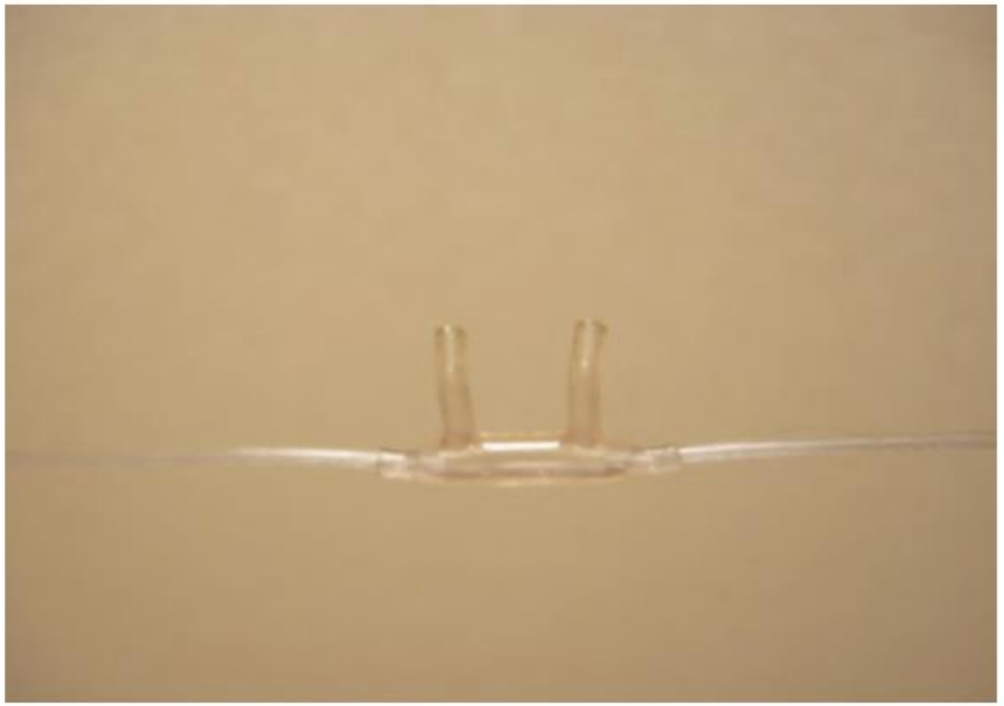


Figure 4.22A Snoring embedded in respiratory waveform: Snoring signals from the airflow waveform can be removed by appropriate filter setting. A: Setting high frequency filter to 50 Hz derivations to appearance of snoring. In this illustration, respiratory waveform is flat as LFF has been mistakenly set as 1 Hz.

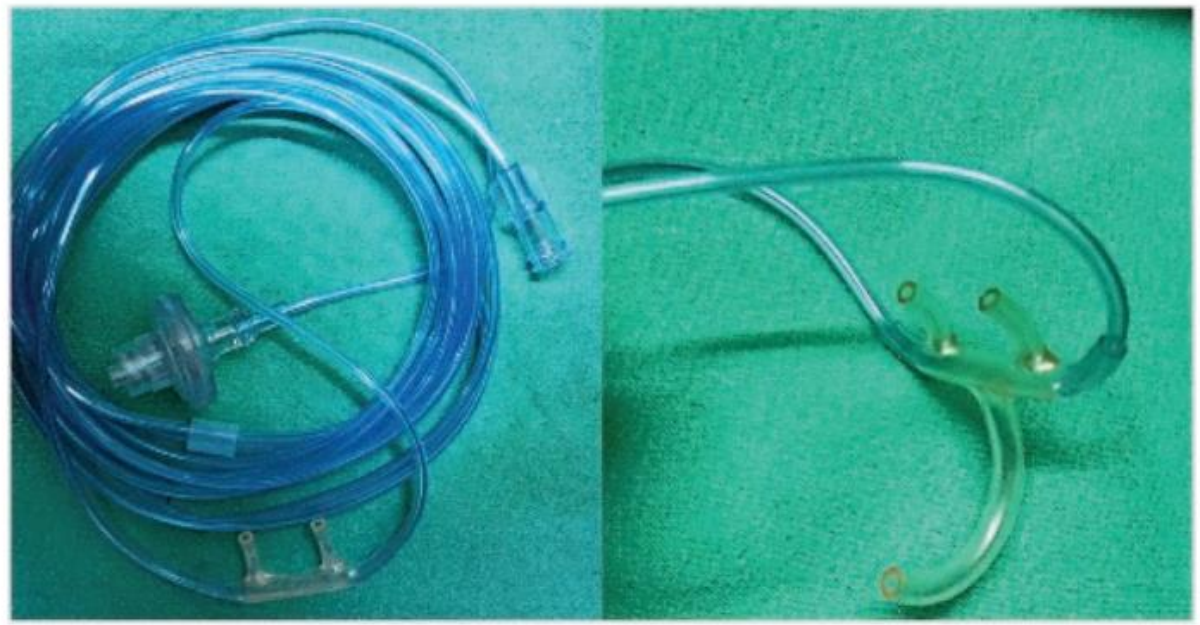
Airflow sensor (수면 무호흡 유무)





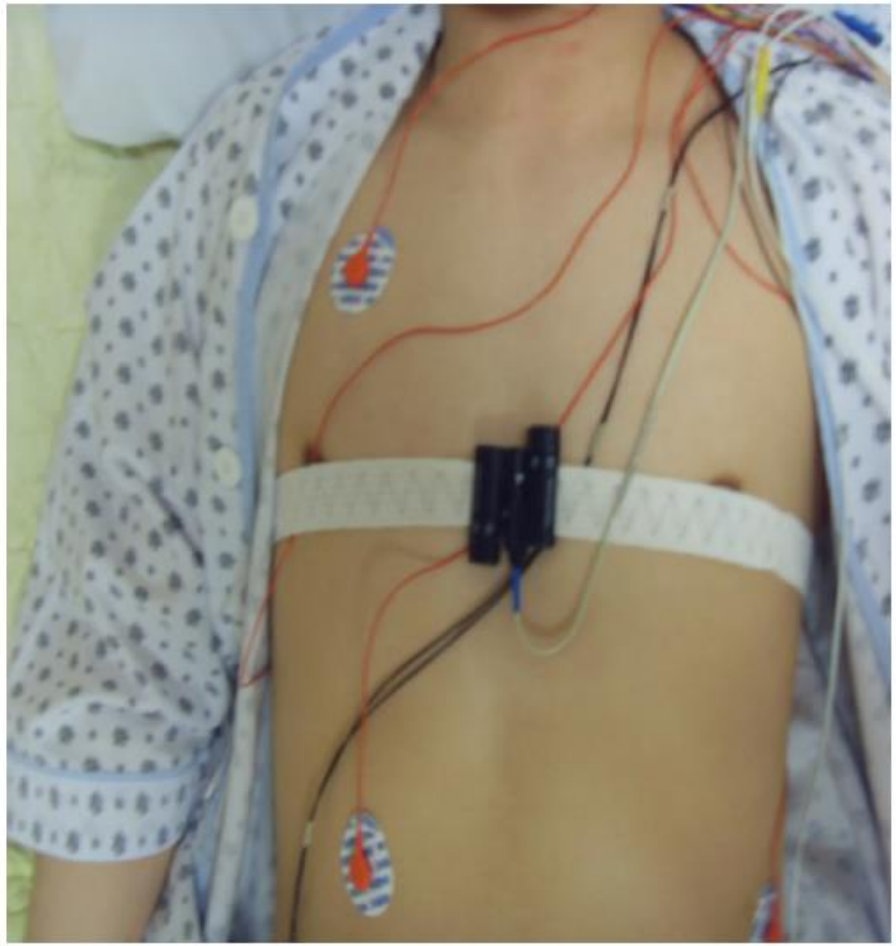


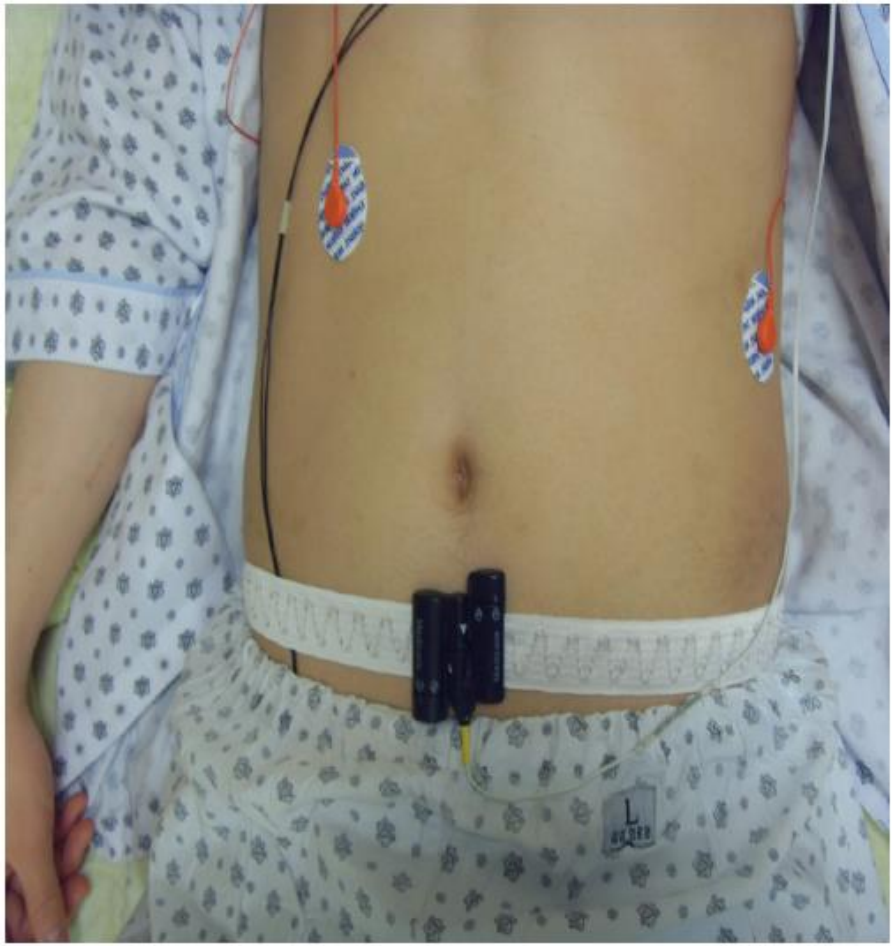
A: Thermisters.



B: Nasal cannula.

흉 복부 호흡운동과 수면 체위 센서



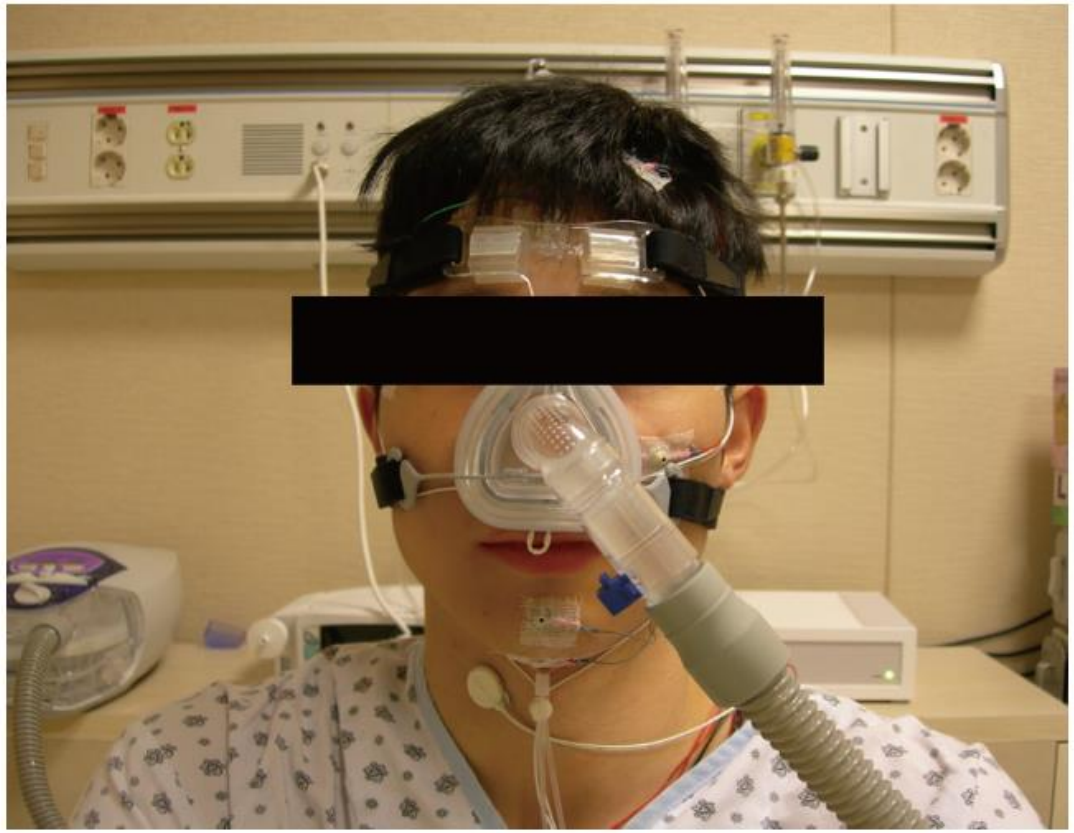


산소포화도 센서 (Pulse Oximeter)

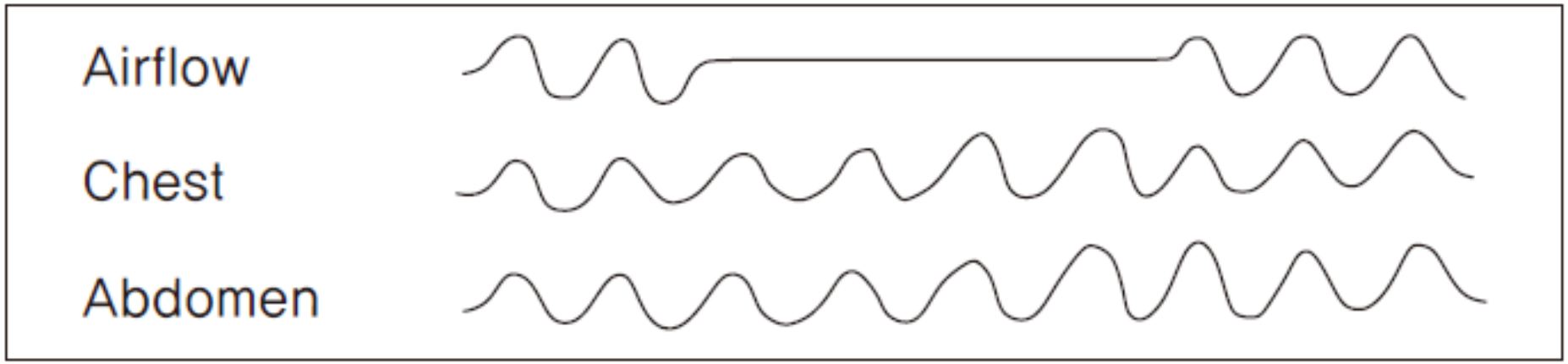


지속적 양압기 (CPAP: Continuous Positive Airway Pressure)





폐쇄성 수면 무호흡 (Obstructive Sleep Apnea: OSA)



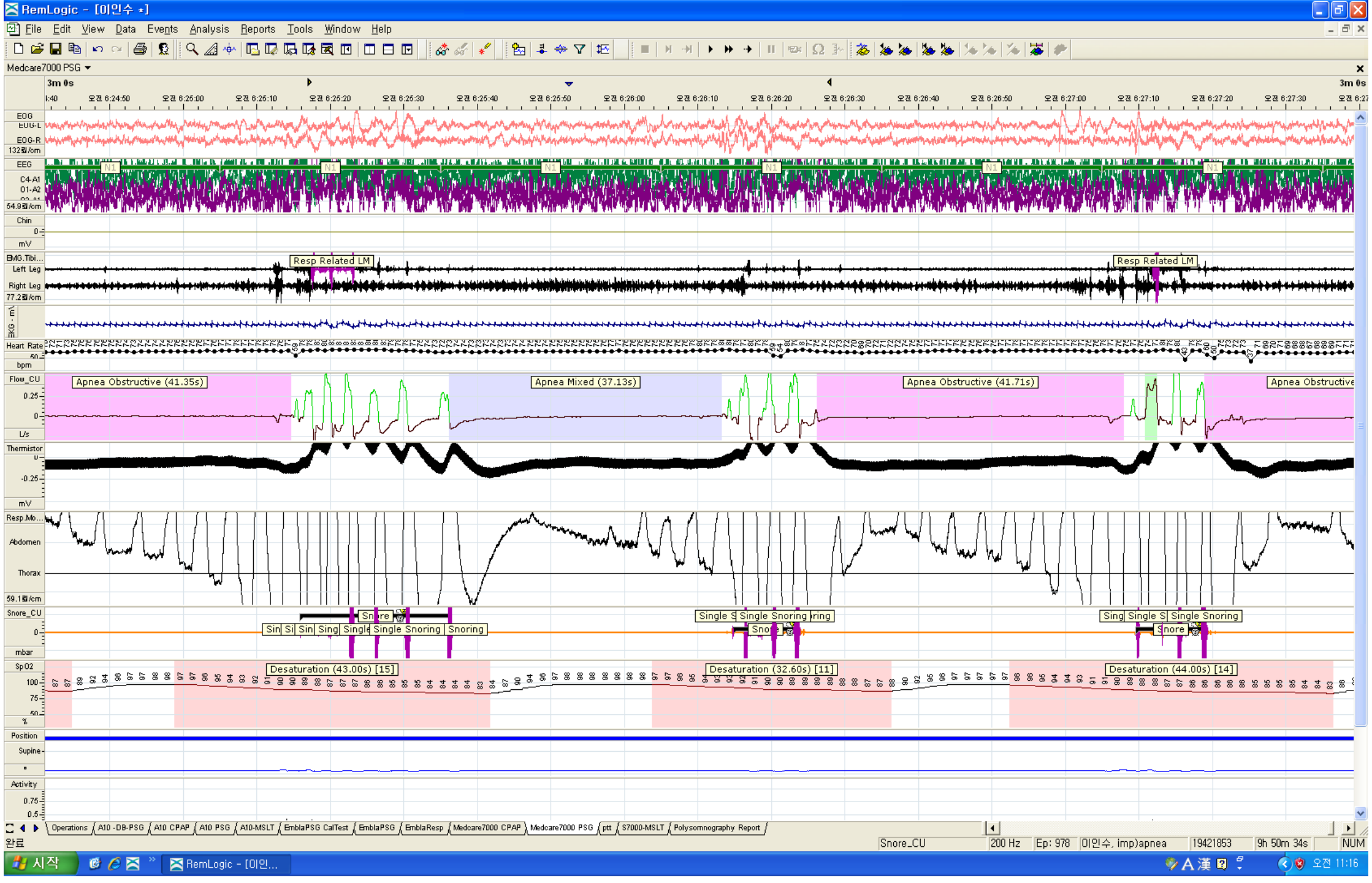

RemLogic - [이인수 *]
File Edit View Data Events Analysis Reports Tools Window Help
Medcare7000 PSG
3m 0s
EOG
EOG-L
EOG-R
EEG
C4-A1
O1-A2
Chin
EMG.Tibi...
Left Leg
Right Leg
Resp Related LM
Resp Related LM
EKG
Heart Rate
bpm
Flow_CU
Apnea Obstructive (41.35s)
Apnea Mixed (37.13s)
Apnea Obstructive (41.71s)
Apnea Obstructive
Thermistor
Resp.Mo...
Abdomen
Thorax
Snore_CU
Snore
Single Snoring
Snore
Snore
SpO2
Desaturation (43.00s) [15]
Desaturation (32.60s) [11]
Desaturation (44.00s) [14]
Position
Supine
Activity
Operations
A10 -DB-PSG
A10 CPAP
A10 PSG
A10-MSLT
EmblaPSG CalTest
EmblaPSG
EmblaResp
Medcare7000 CPAP
Medcare7000 PSG
ptt
S7000-MSLT
Polysomnography Report
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9h 50m 34s
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FIGURE 13.2-24. Obstructive sleep apnea (OSA) in an obese teen. This figure illustrates a 5-minute epoch of a 13-year-old who weighed 225 pounds and had tonsillar hypertrophy. At presentation, the patient complained of snoring and daytime hypersomnolence. His apnea-hypopnea index (AHI) was 42 respiratory events per hour with lowest measured oxygen saturation of 62%. Forgoing adenotonsillectomy for treatment, the patient underwent nasal continuous positive airway pressure titration with resolution of his OSA. AHI scores are higher in obese compared with normal-weight children with OSA. Obese children are also less responsive to adenotonsillectomy as treatment compared with normal-weight children.

Central Sleep Apnea

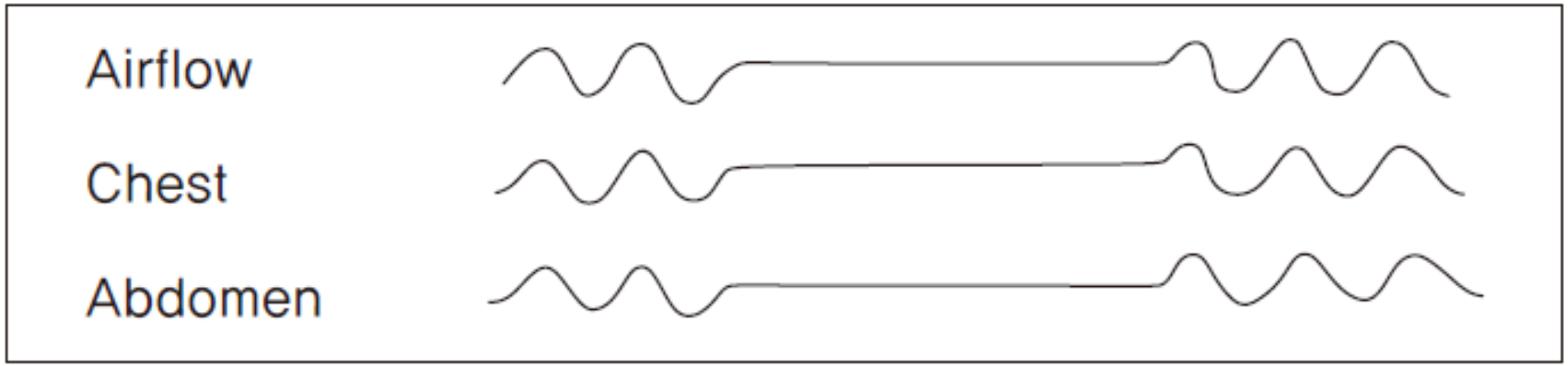




FIGURE 13.2-7. Central apnea. A 30-second epoch (*top*) and a 5-minute epoch (*bottom*). These are repetitive episodes of central apnea in a 44-year-old patient using opiates for pain in an injured ankle. Notice the small number of breaths in each cycle. Cardiogenic oscillations are evident in the CO_2 trace and are best seen in the third apneic episode from the right.

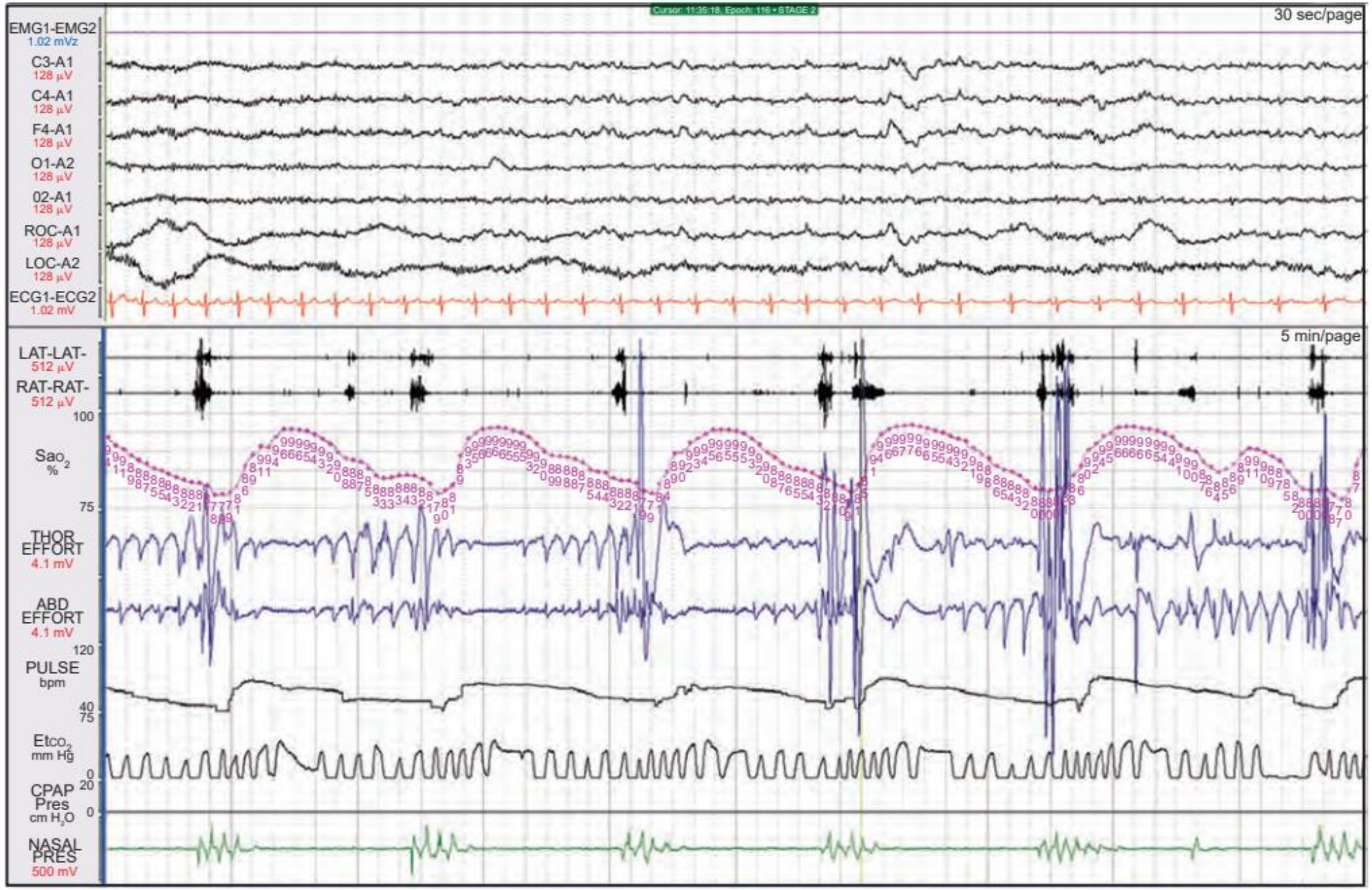


FIGURE 13.2-14. Mixed apnea usually begins with central apnea and ends with obstructive apnea. In this example, vigorous leg movements occurred at the end of the apneic episodes. Continuous positive airway pressure abolished the apneas, but the leg movements persisted.

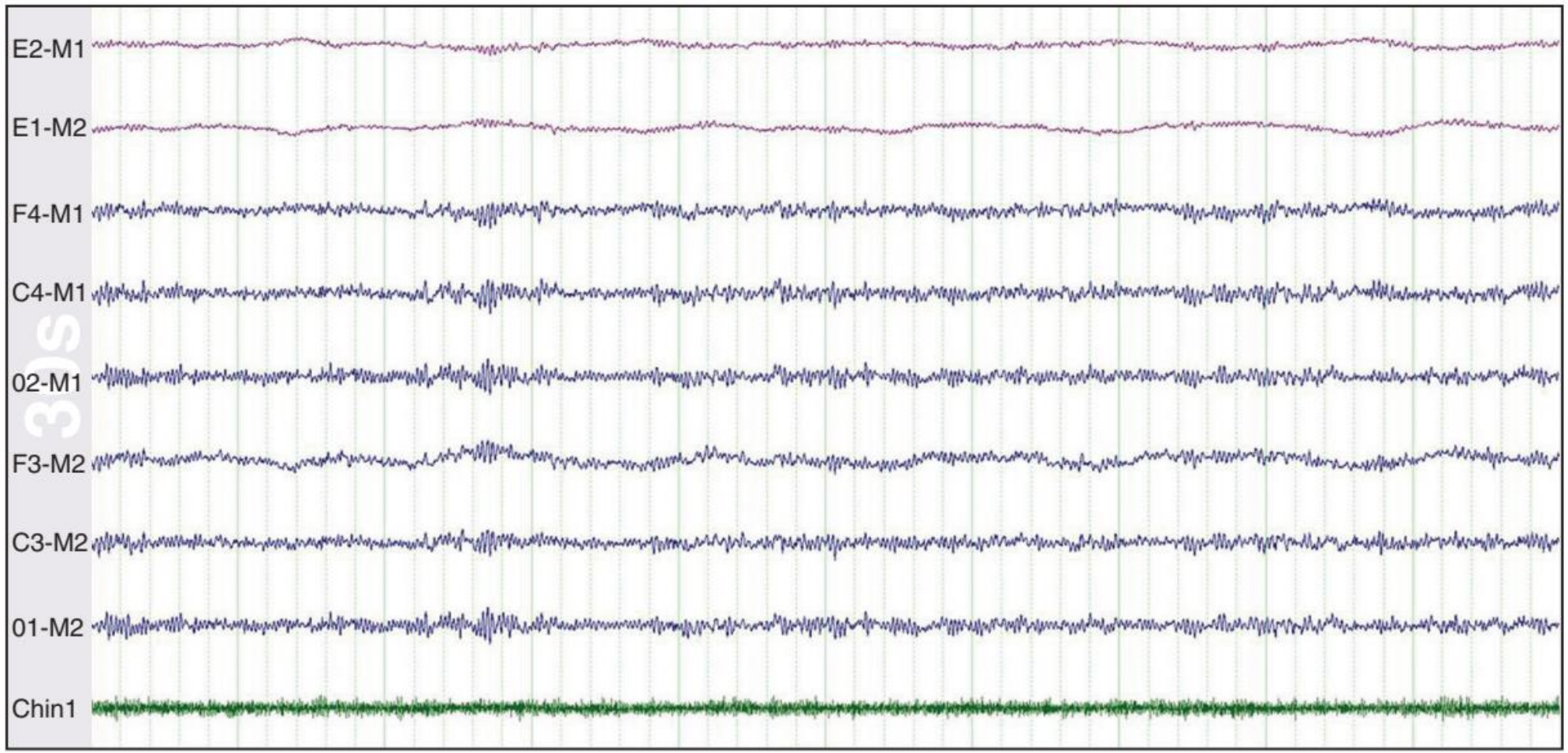


FIGURE 4.2-12. Stage W (wakefulness). This fragment is a 30-second epoch. The two top channels represent the channels that monitor eye movements. The next six channels are used to record the electroencephalogram (EEG). The first three of these (F_4-M_1, C_4-M_1, O_2-M_1) are recommended for scoring sleep. The others are backups in case electrodes malfunction. The bottom channel is the chin electromyogram. The key finding that indicates this is wakefulness is the presence of alpha rhythm over the occipital region (monitored by the O leads) occupying more than 30 seconds of the epoch.

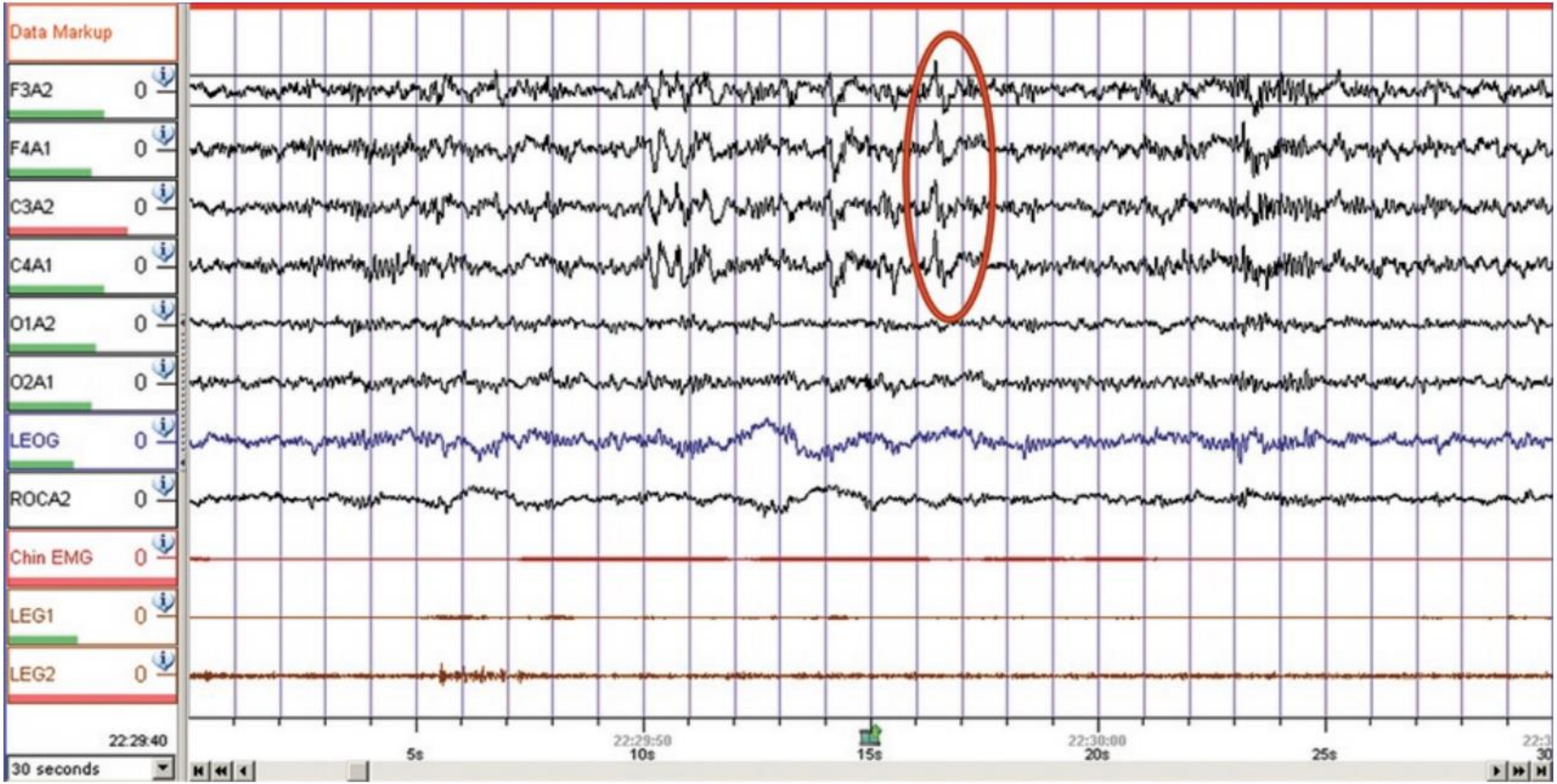


Figure 1.4 30 seconds epoch showing N1 sleep: This epoch shows mix EEG activity (alpha and theta) along with vertex waves (in circle).

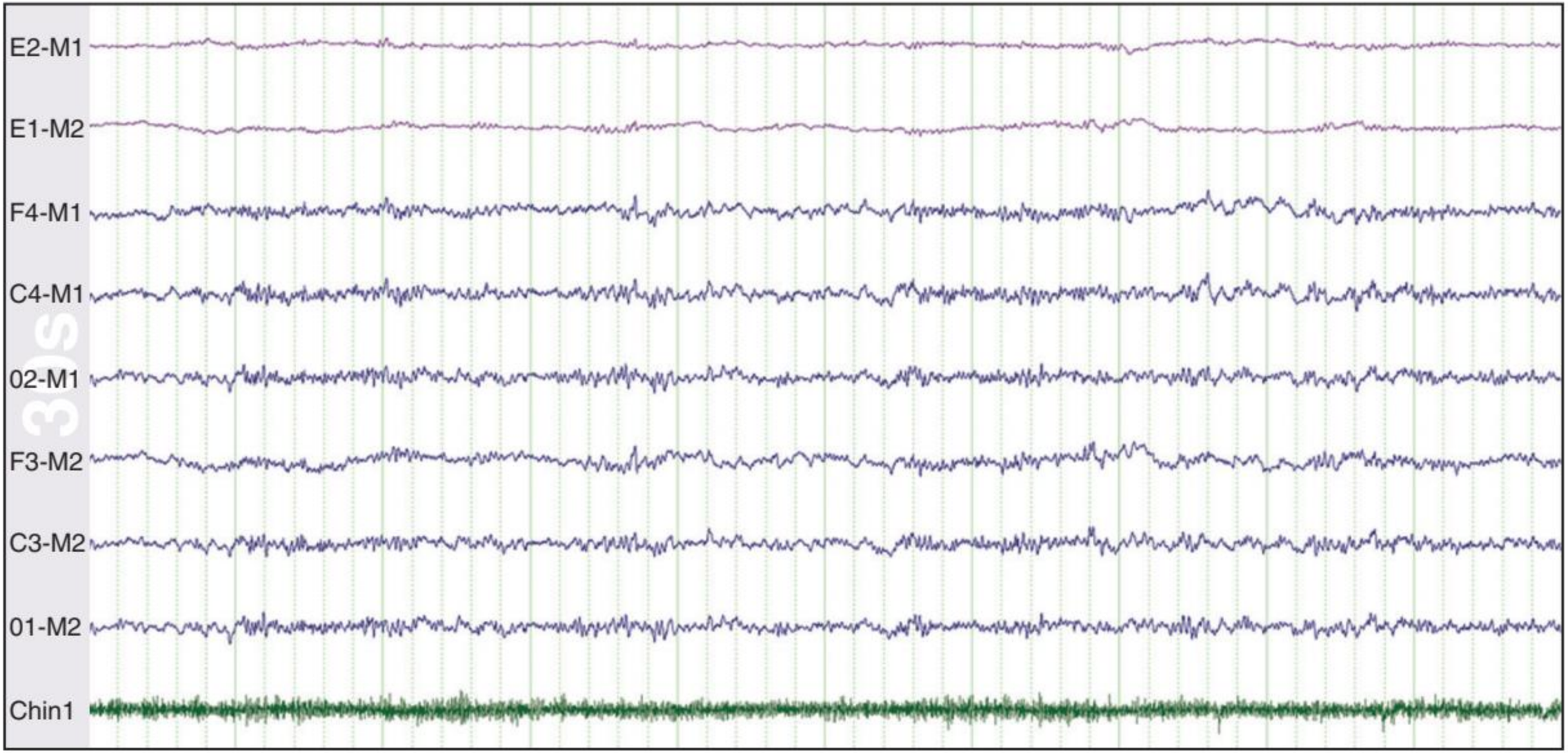


FIGURE 4.2-13. Stage N1. A mixed frequency, low-amplitude pattern has replaced the alpha rhythm for >50% of the epoch.

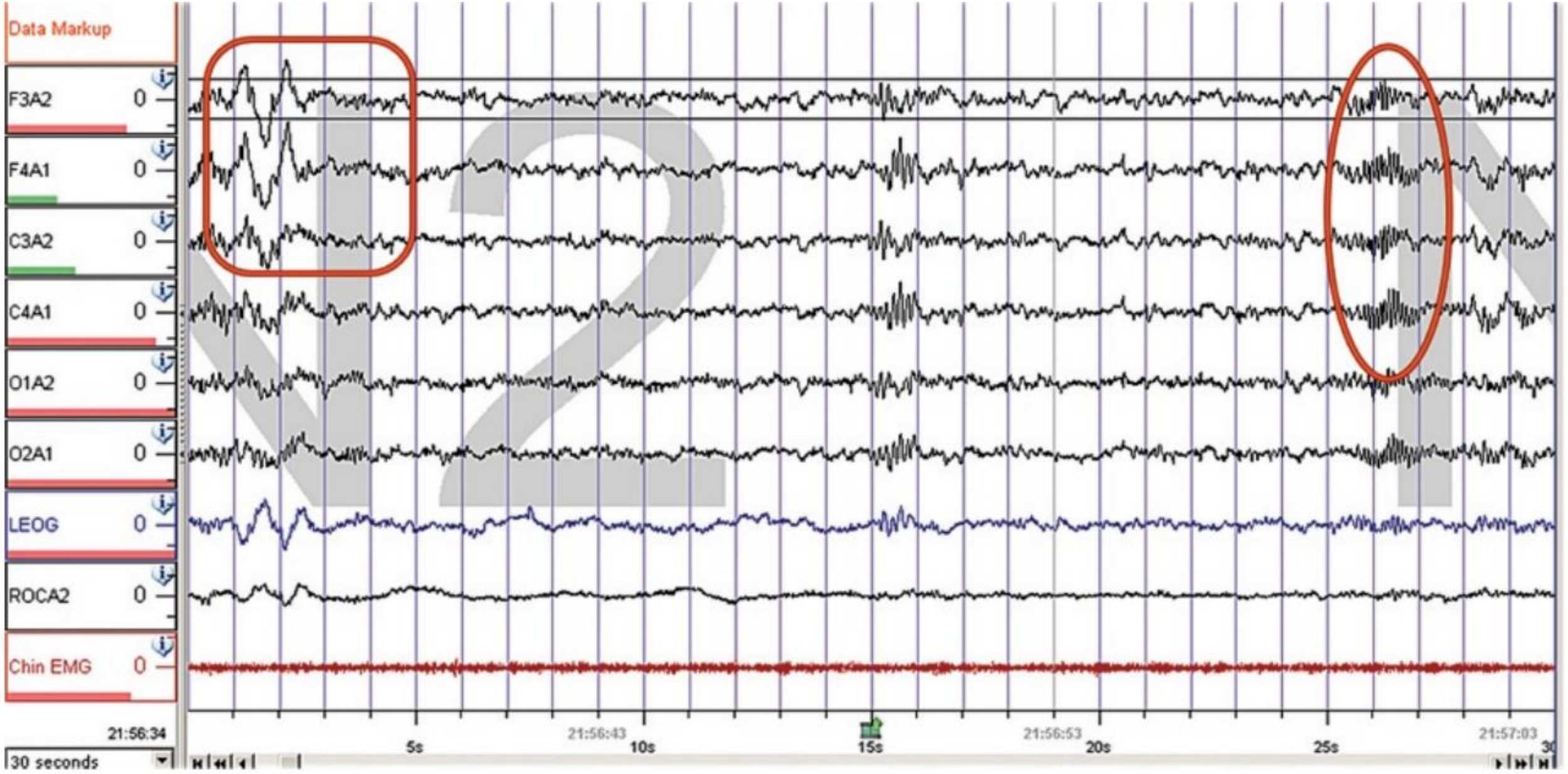


Figure 1.5 30 seconds epoch showing N2 sleep: In this epoch K complex can be seen in the square box and sleep-spindle in circle. Background EEG activity is in theta range.

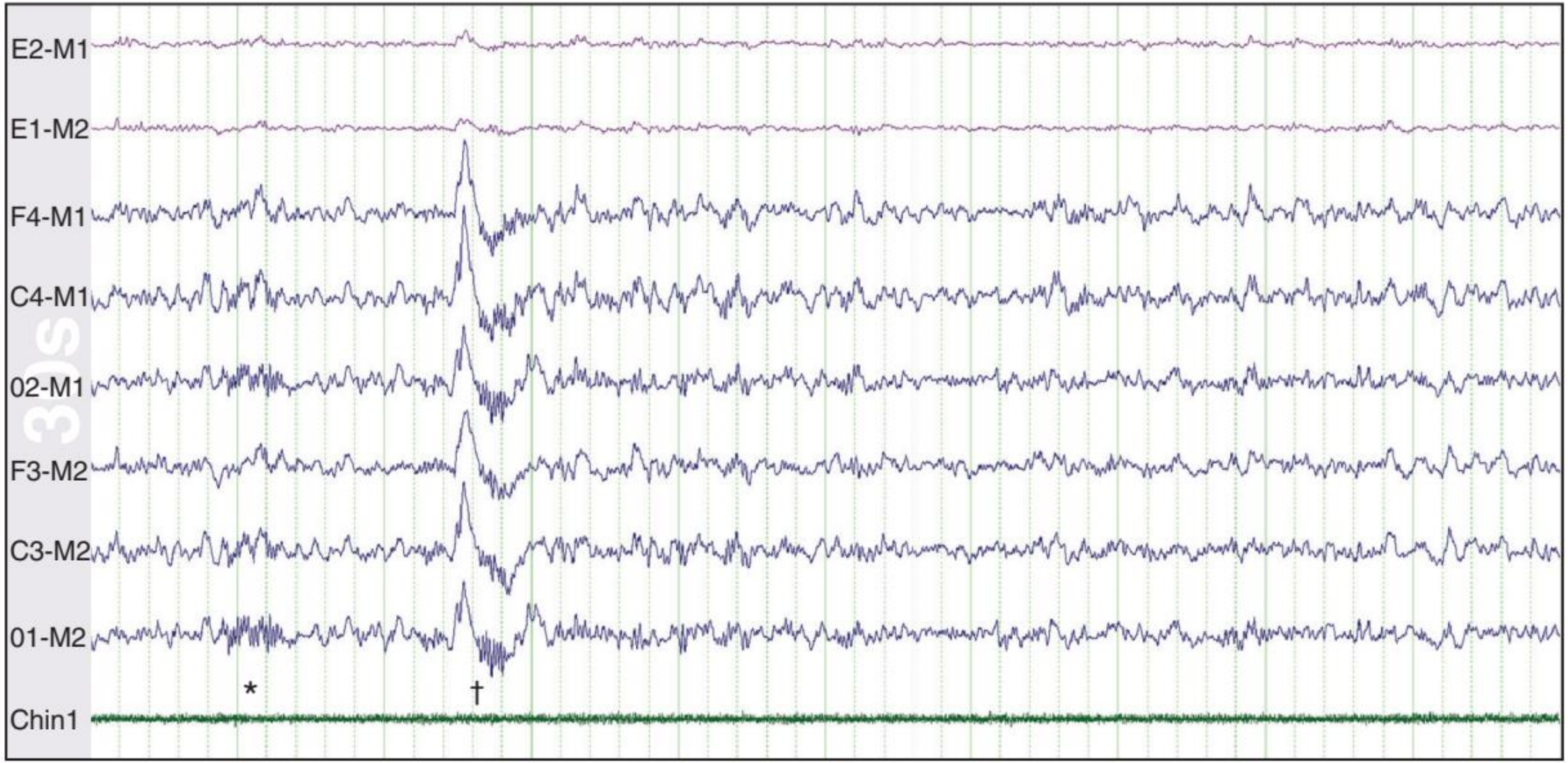


FIGURE 4.2-14. Stage N2. A train of sleep spindles (asterisk) toward the beginning of the epoch is followed shortly by a K-complex (dagger).

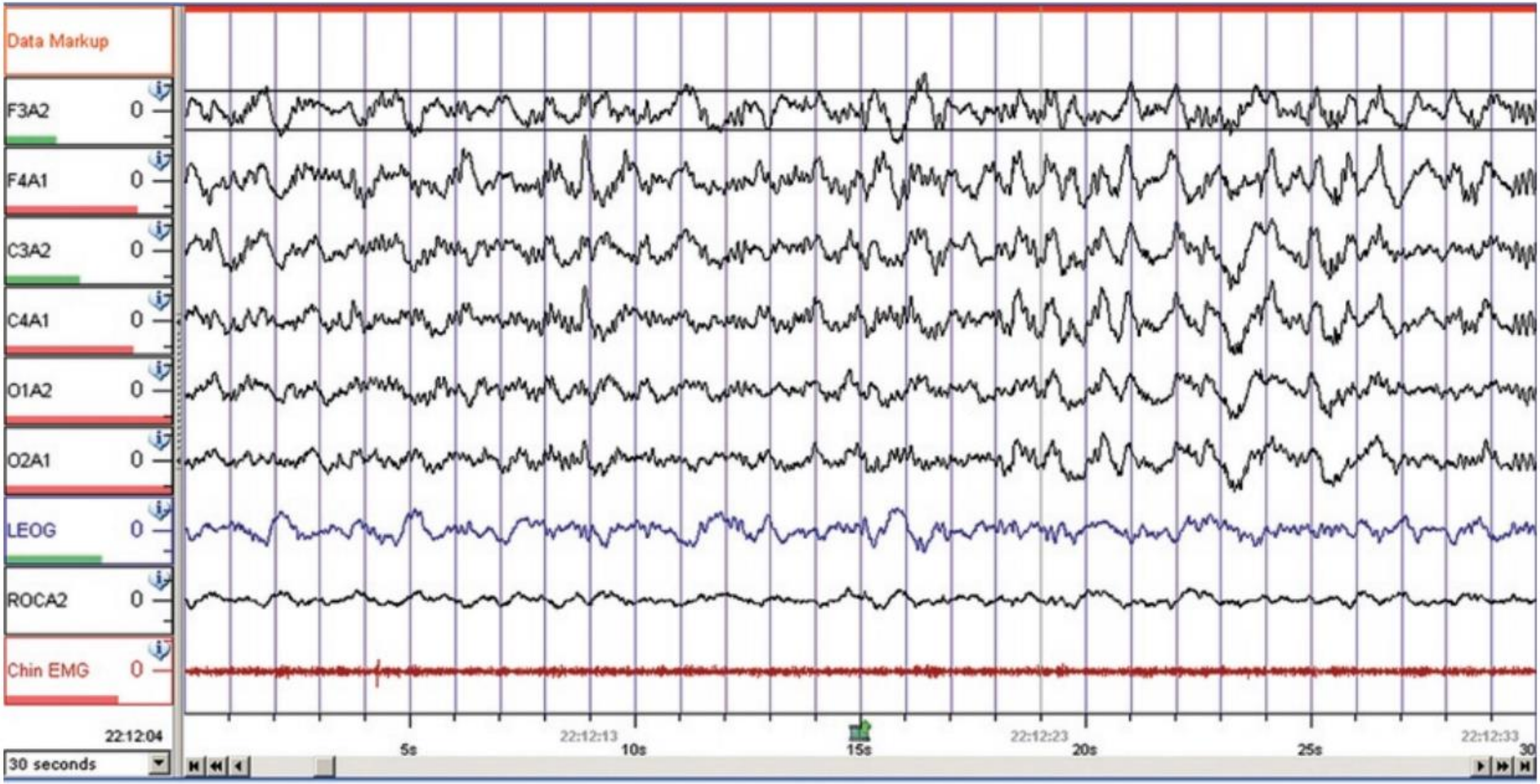


Figure 1.6 30 seconds epoch showing N3 sleep: This epoch show delta activity. Delta waves are also known as slow waves with frequency of 0.5–2 Hz and amplitude of more than 75 mV.

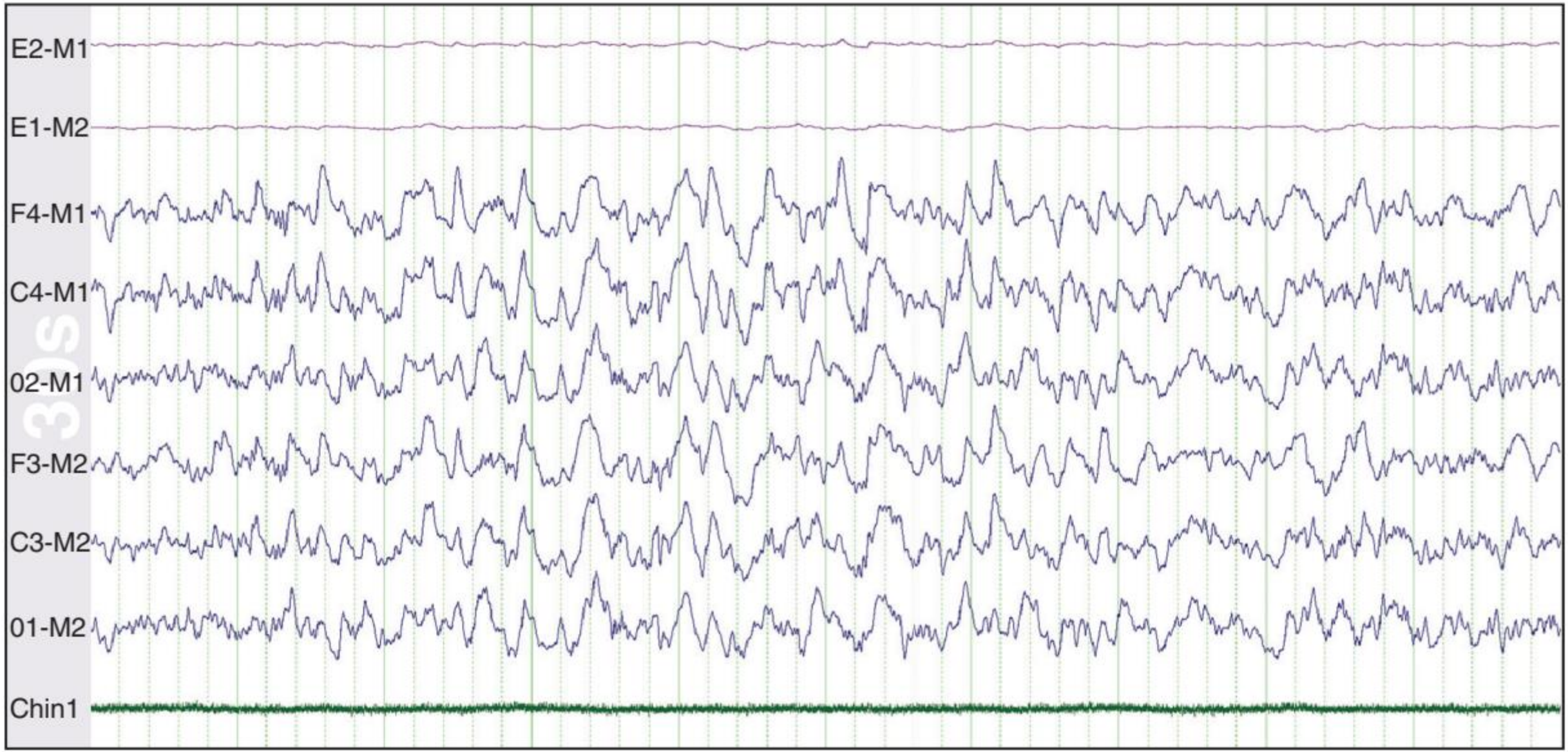


FIGURE 4.2-15. Stage N3. More than 20% of the epoch consists of slow-wave activity.

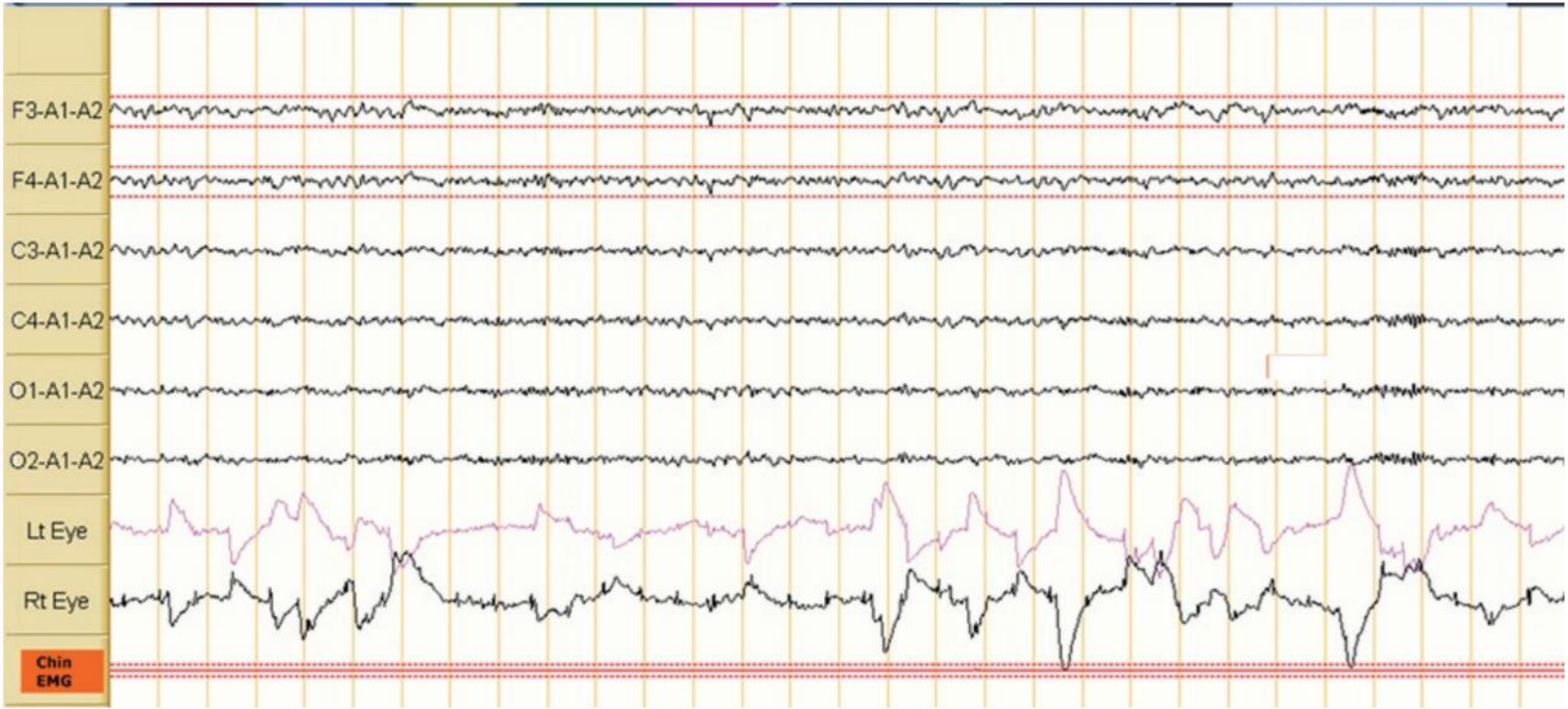


Figure 1.7 30 seconds epoch showing REM sleep: REM sleep is characterized by low voltage mixed frequency activity, rapid eye movements and atonia.

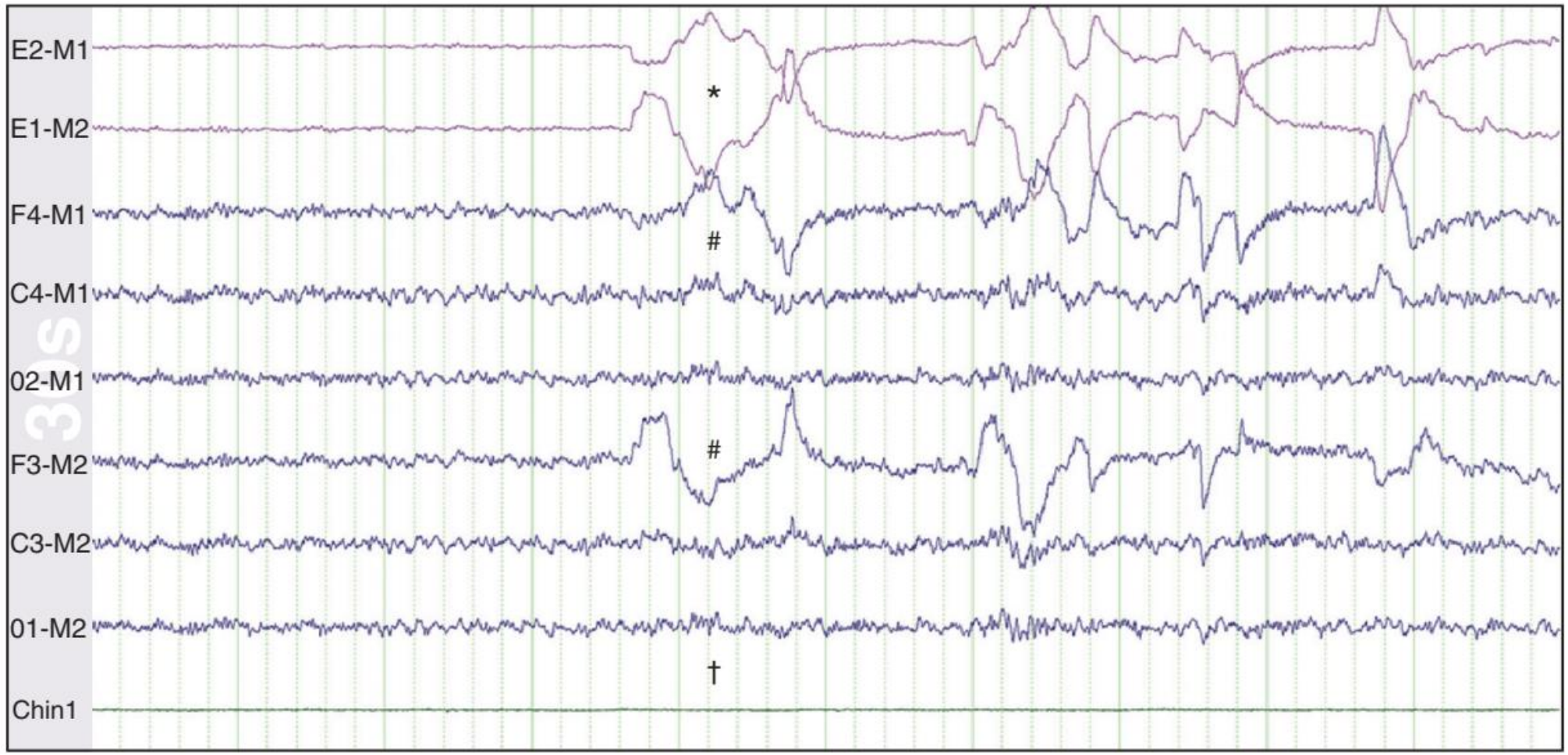


FIGURE 4.2-16. Stage R. Rapid eye movements (*) and a mixed-frequency, low-amplitude electroencephalogram are shown; muscle tone (chin electromyogram) is absent (†). Note that some of the activity of the eyes has spilled over into the two frontal (F) leads (#).