Form of Flow Chart to Hand Down Expertise and Skills

- Clasification Algorithm of REM Sleep Behavior Disorder as an Example -

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Sleeping disorder

A sleep disorder, or somnipathy, is a medical disorder of the sleep patterns of a person or animal. Some sleep disorders are serious enough to interfere with normal physical, mental, social and emotional functioning.

- Insomnia Disorder
- Sleep Related Breathing Disorders
- Central Disorders of Hypersomnolence
- Circadian Rhythm Sleep-Wake Disorders
- Parasomnias → REM sleep behavior disorder (RBD)
- Sleep Related Movement Disorders
- Other Sleep Disorders

Introduction

For most people, dreaming is purely a "mental" activity: dreams occur in the mind while the body is at rest.
But people who suffer from RBD act out their dreams.

They physically move limbs or even get up and engage in activities associated with waking.
Some engage in sleep talking, shouting, screaming, hittting or punching. Some even fly out of bed while sleeping.

RBD is usually noticed when it causes danger to the sleeping person, their bed partner, or others they encounter.

Aim in this study

RBD is well-known REM sleep without atonia involves increased muscle activity, as seen on electromyography channels during polysomnography.

Evaluation is required to hand down expertise and skills.

Although close follow-up of patients' recovery process is required and several visual inspection methods have been developed for the PSG reading, clear diagnostic criteria for assessing RBD severity have not been established because of the complicated nature of the procedure.

In this study, we discuss the automatic algorithm to help diagnosing and evaluating severity of a sleep disorder.
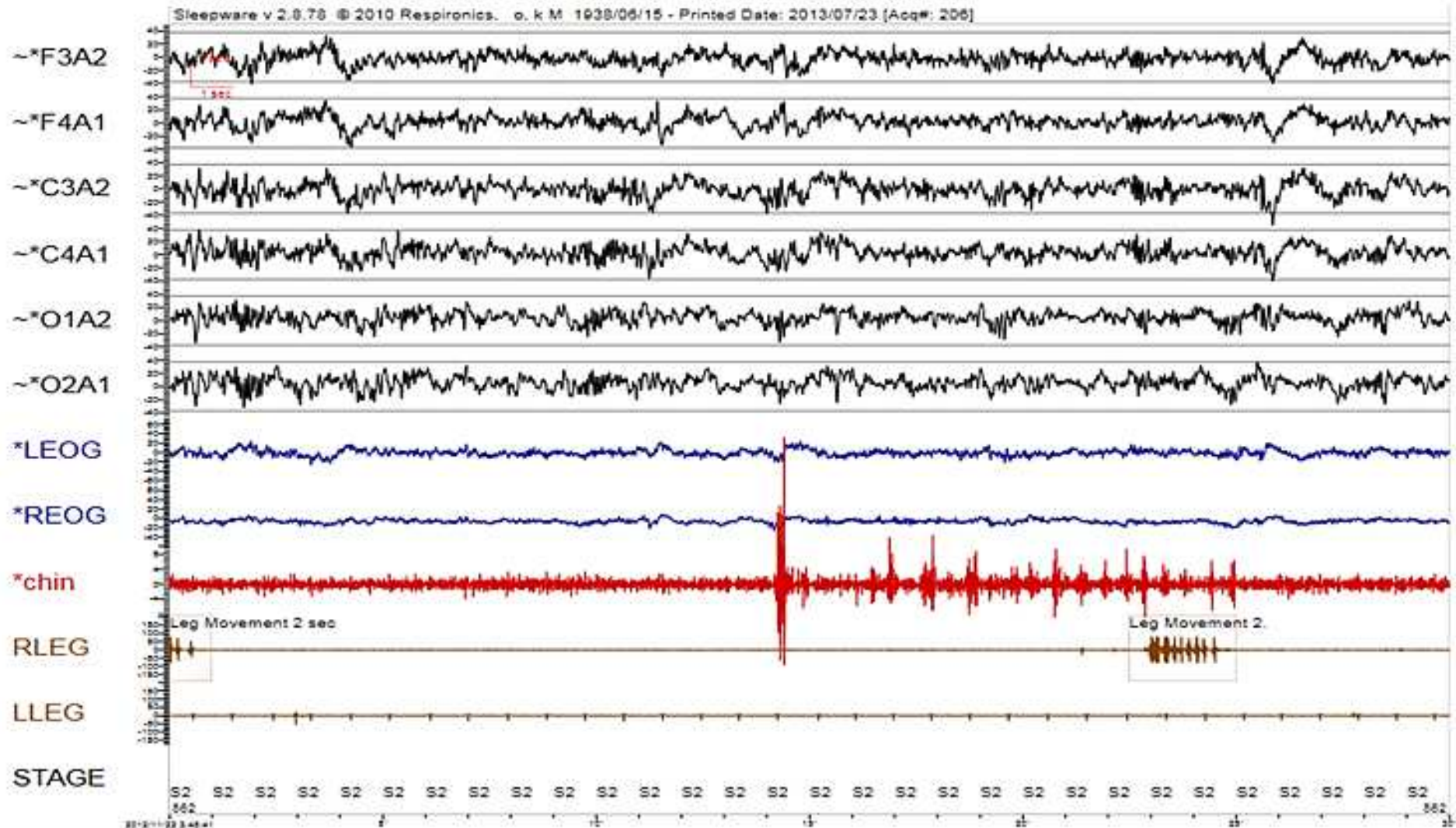
Methods

● Subject
  12 patients of the RBD is suspected
  (72.3 ± 1.7 years)

● Measurement content
  Measurement of muscle activity of the chin muscle by PSGs

| Time	Protocol
19:00	Mounting of the equipment
	Recording Start
22:00	Extinction
5:00	Lighting and Recording End

Output example of PSGs
(30 minutes)

Analytical Index

The AASM Sleep Scoring Manual (AASM)

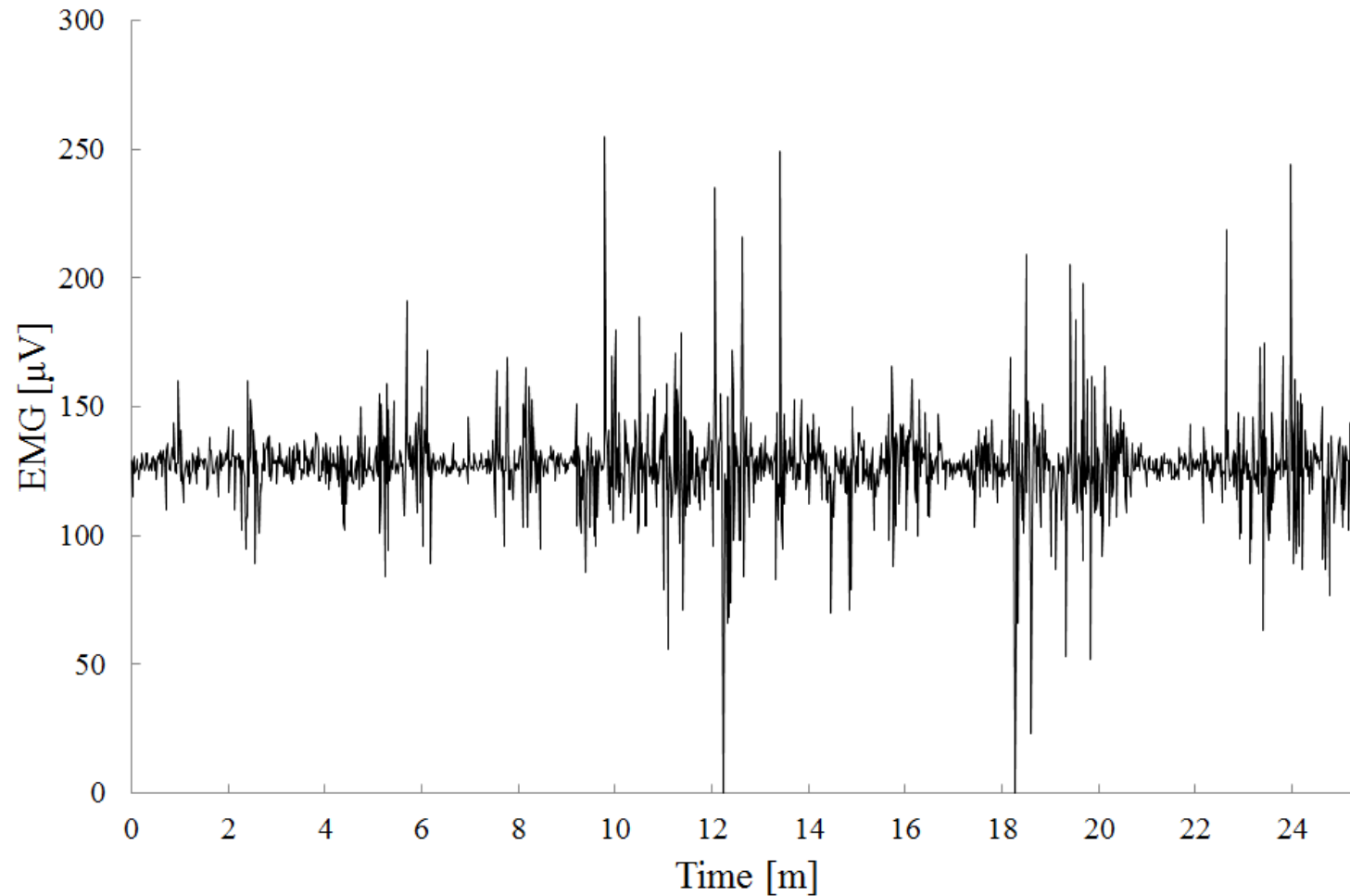| Component	Epoch	Duration Time	Mini Epoch	Amplitude (μV)
Tonic	30 (s)	15 (s)		Amplitude greater than the minimum amplitude during NREM Sleep.
Phasic		0.1 - 5.0 (s)	3 (s)	Amplitude at least four times the amplitude of the background activity.
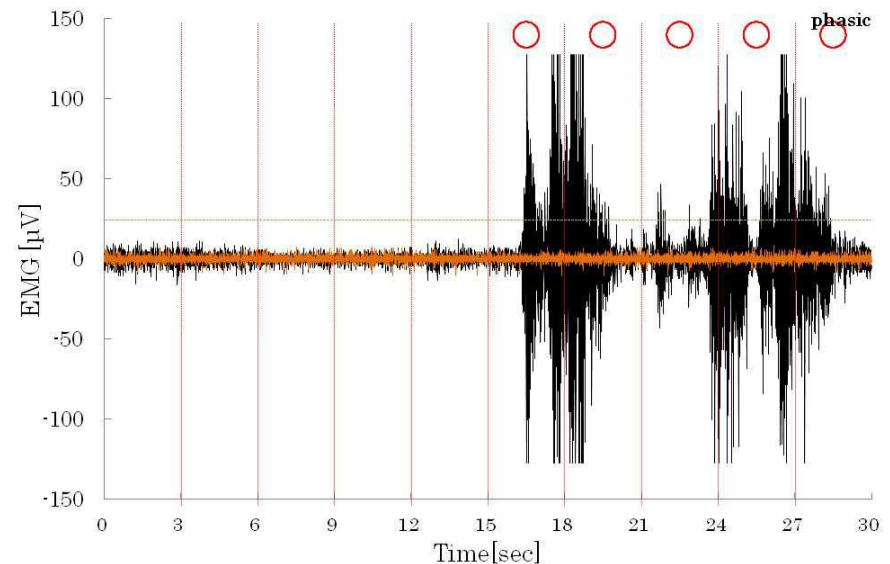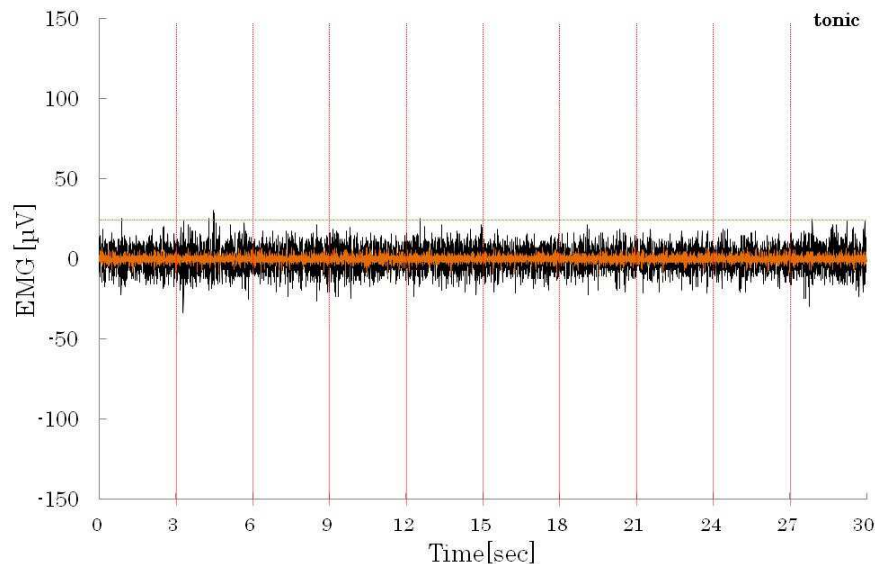
Automatic Algorithm

To extract the REM interval from EMG using EEG and EOG
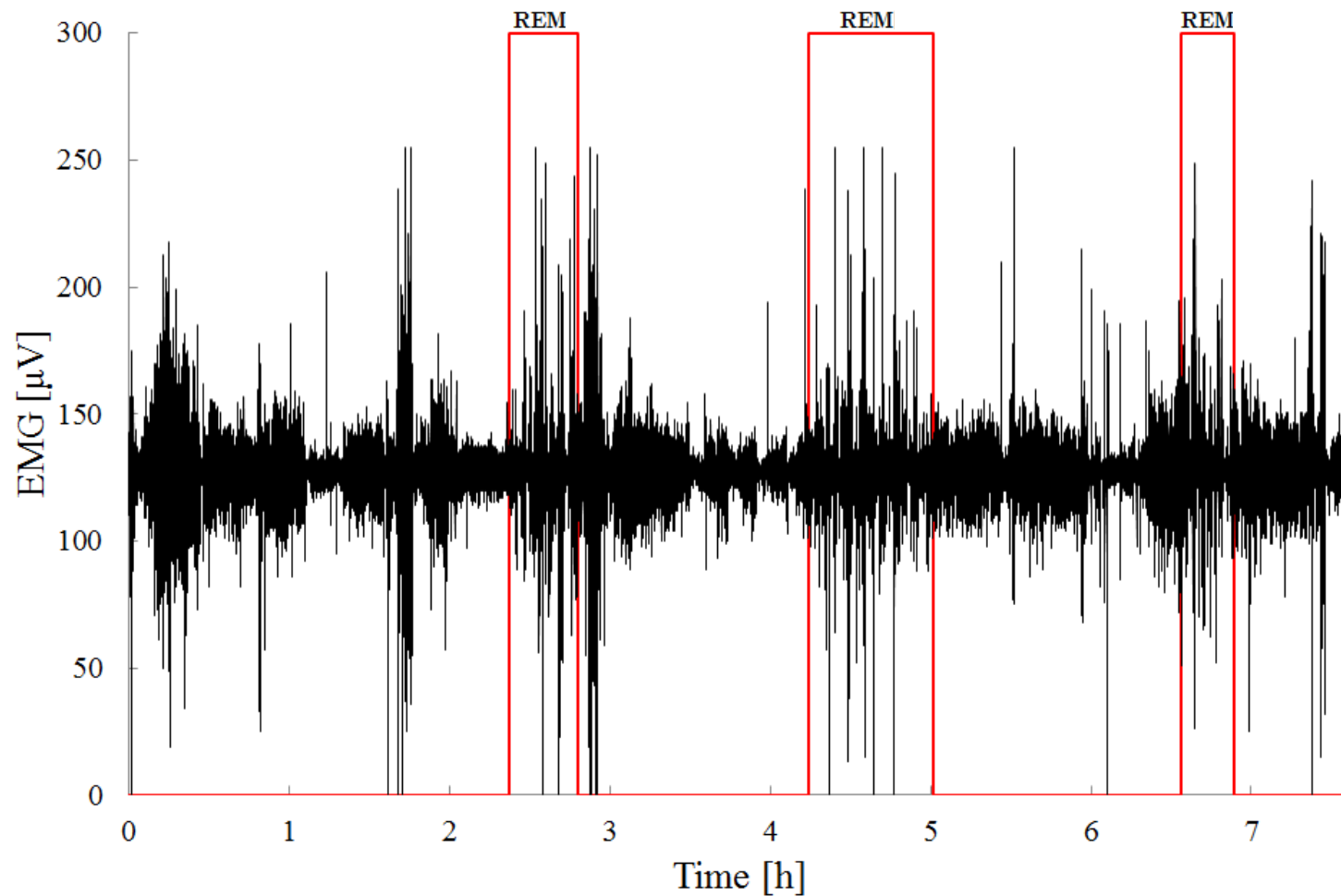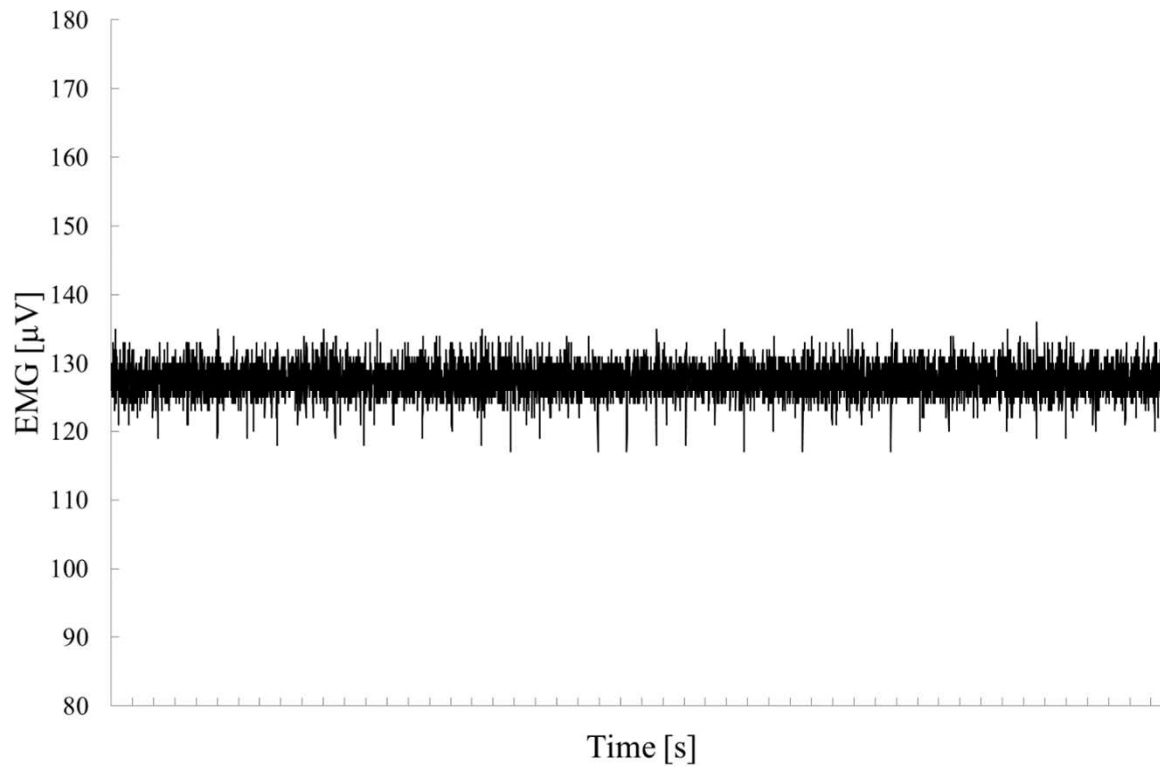
Automatic Algorithm

To divide the extracted REM interval to every 30 seconds

Automatic Algorithm

Derivation algorism of Tonic

① To extract minimum amplitude during NREM Sleep (30s).

② Normalization
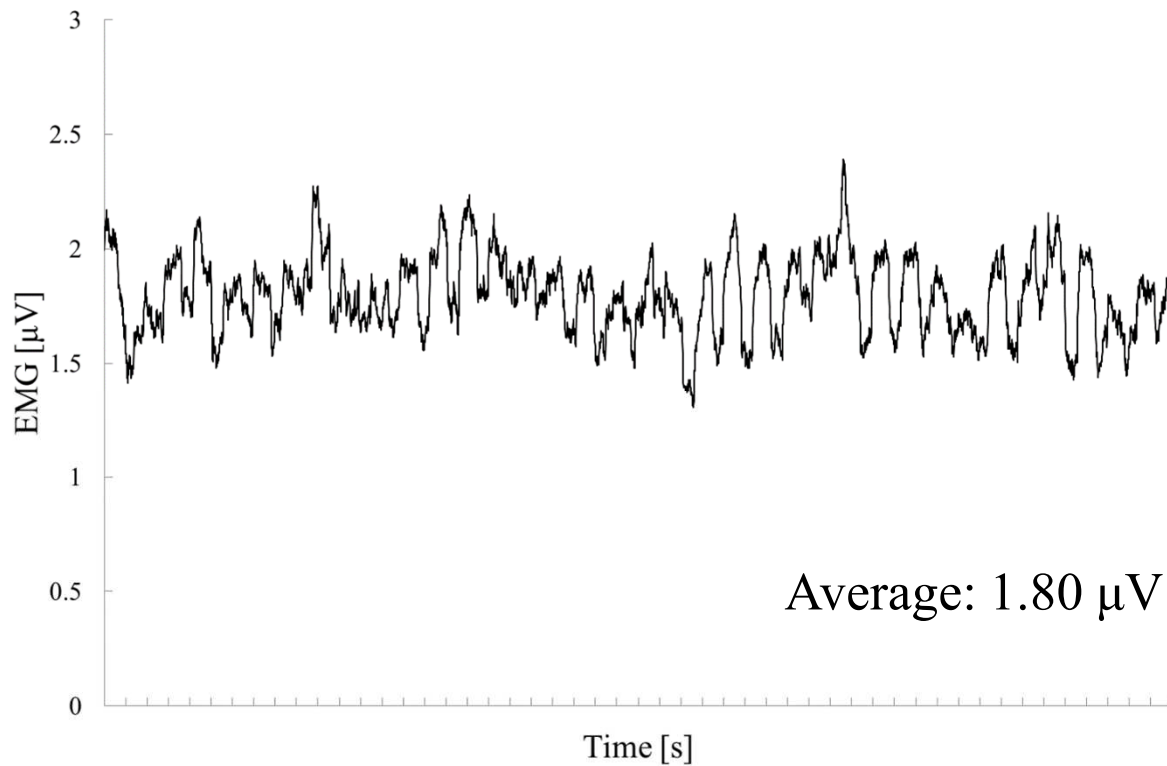
③ Rectification smoothing

④ Get average value (T1)

Automatic Algorithm

Derivation algorism of Tonic

① To extract minimum amplitude during NREM Sleep (30s).
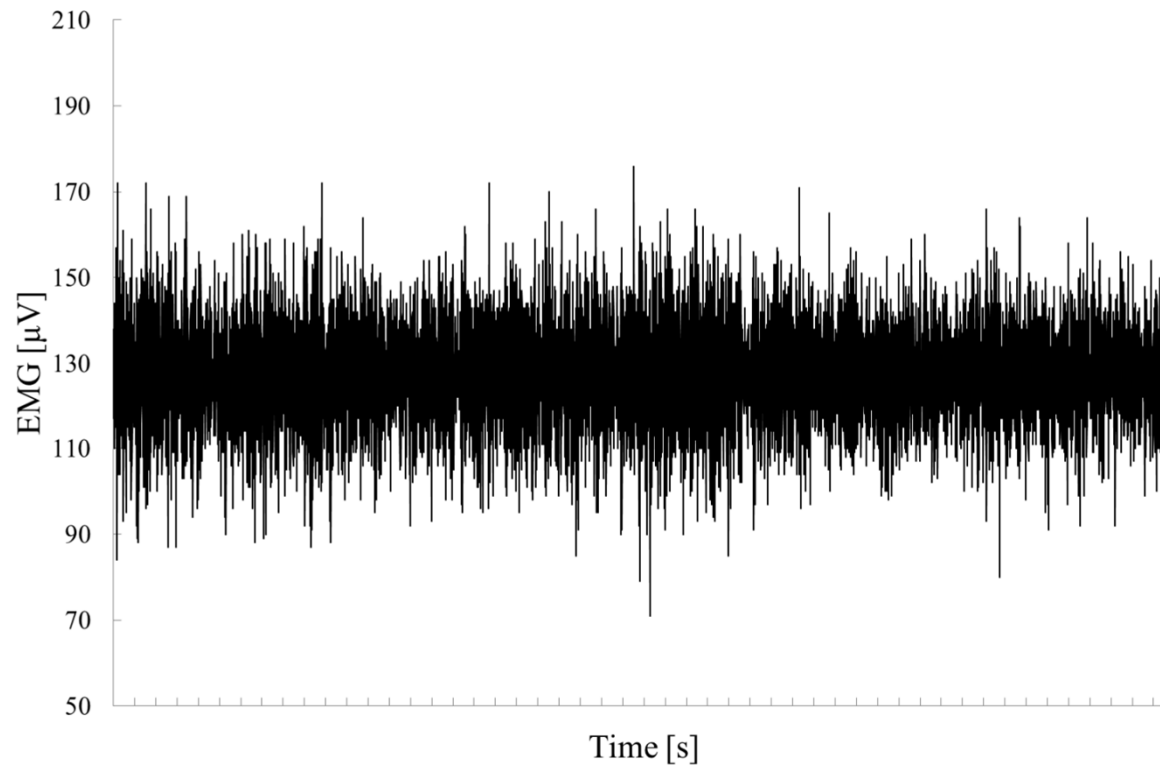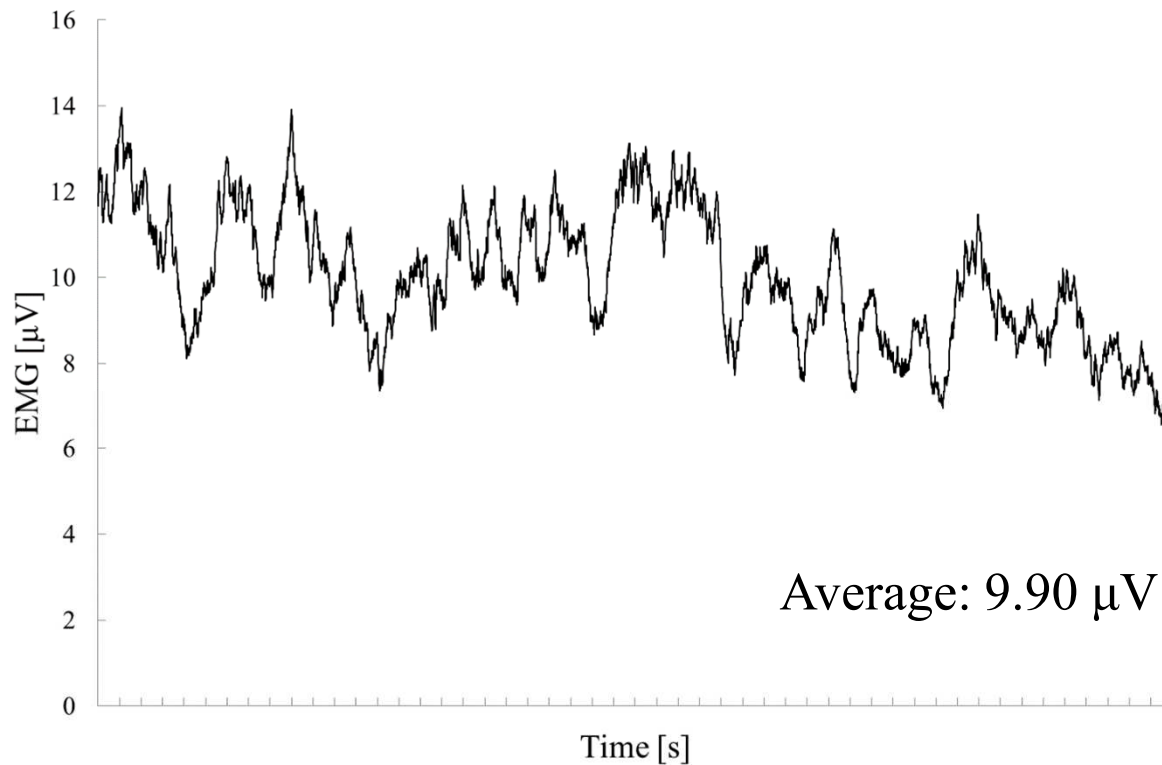

Average: 1.80 μV

↓

② Normalization

↓

③ Rectification smoothing

↓

④ Get average value (T1)

Automatic Algorithm

Derivation algorism of Tonic

① To extract amplitude during REM Sleep (30s).

② Normalization

③ Rectification smoothing

④ Get average value (T2)

Automatic Algorithm

Derivation algorism of Tonic

① To extract amplitude during REM Sleep (30s).

Average: 9.90 μV

↓

② Normalization

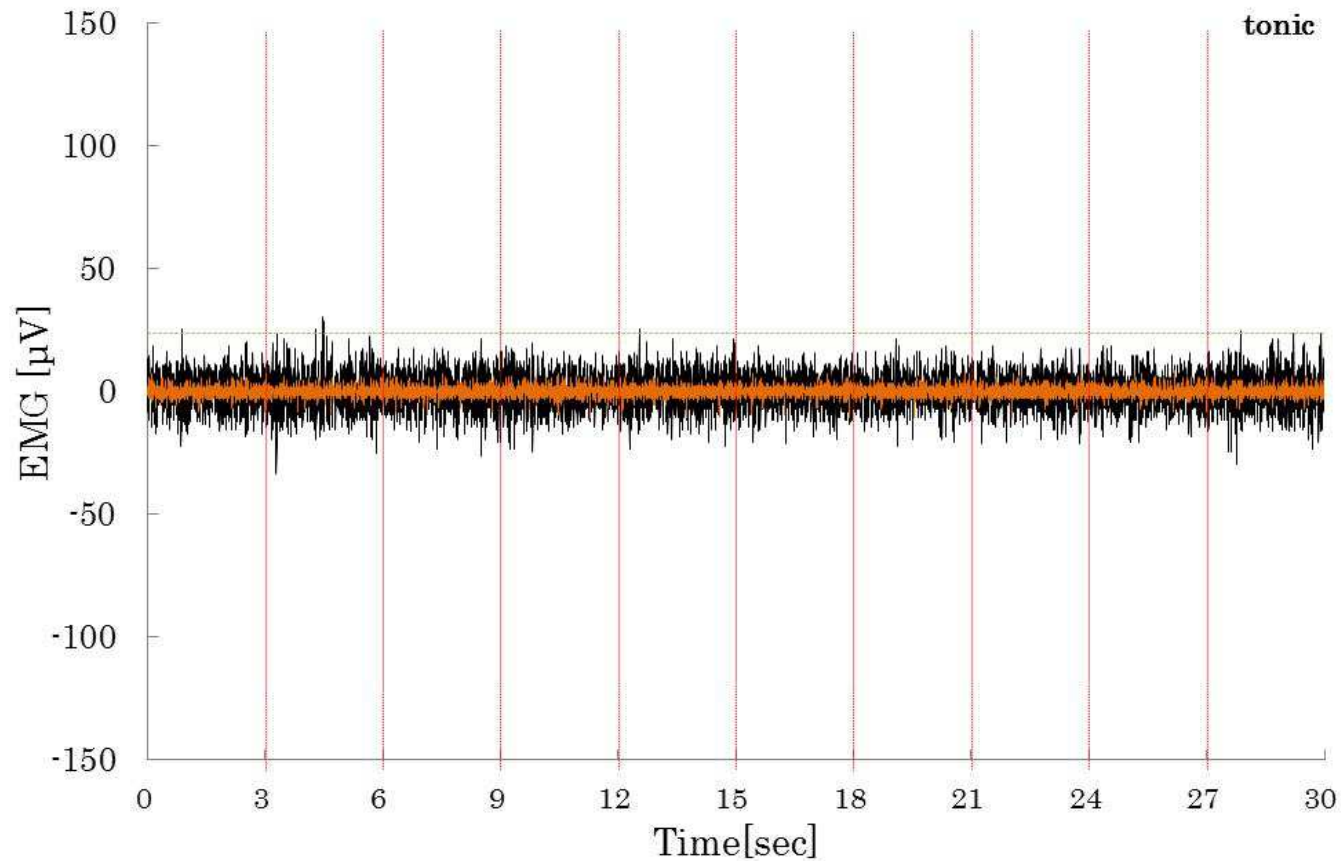↓

③ Rectification smoothing

↓

④ Get average value (T2)
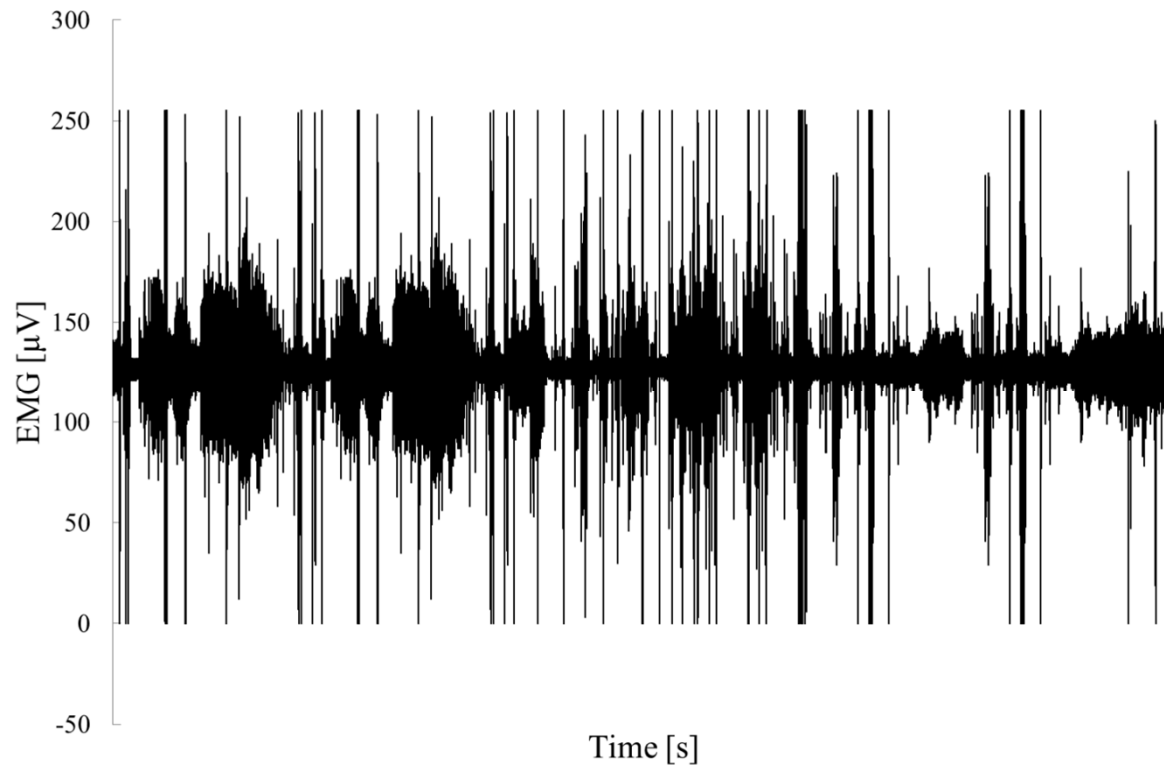
Automatic Algorithm

Derivation algorism of Tonic

If when the average value of T2 is greater than T1 , determines that the Tonic.

Automatic Algorithm

Derivation algorism of Phasic

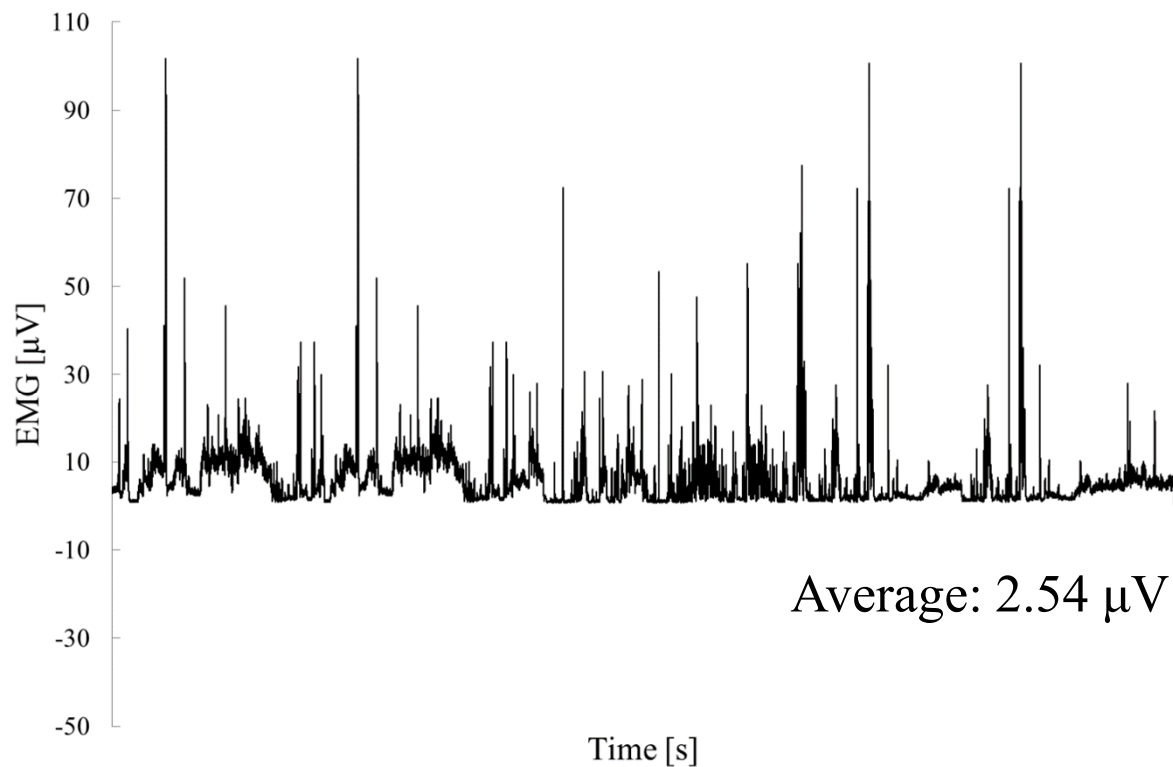① To extract amplitude of the background activity during REM Sleep.

② Normalization

③ Rectification smoothing

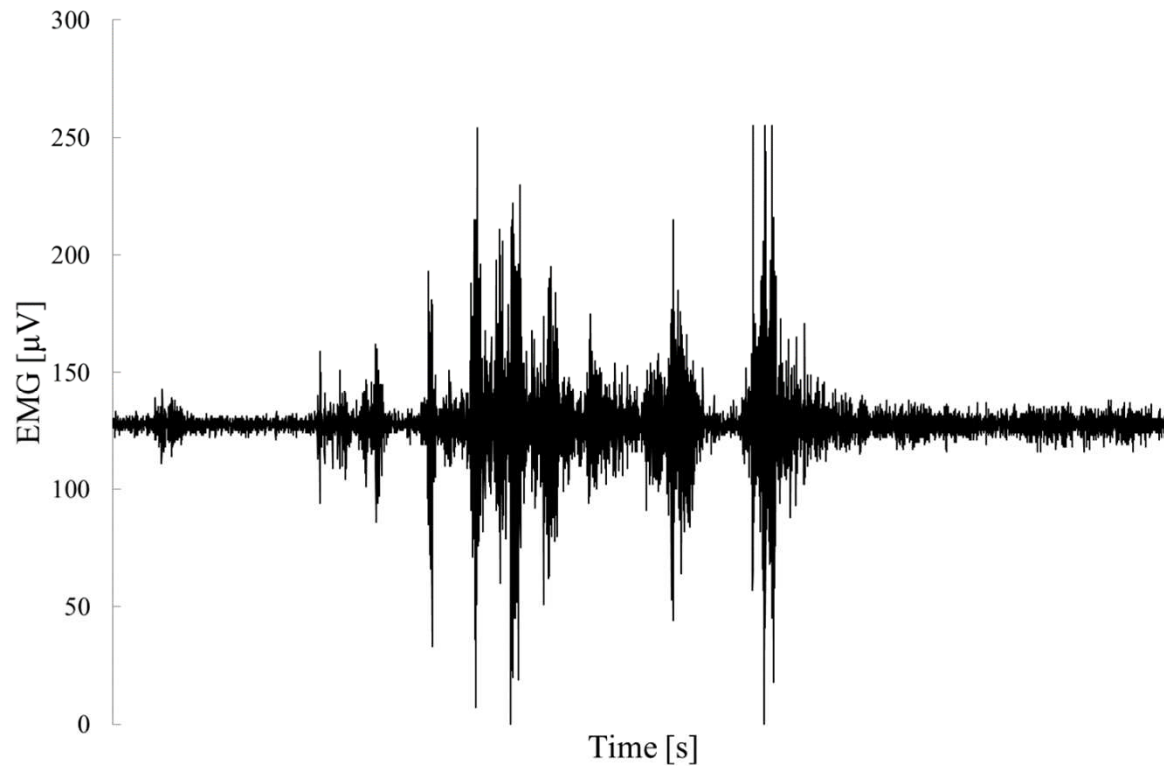④ Get average value (P1)

Automatic Algorithm

Derivation algorism of Phasic

① To extract amplitude of the background activity during REM Sleep.

Average: 2.54 μV

② Normalization

③ Rectification smoothing

④ Get average value (P1)

Automatic Algorithm

Derivation algorism of Phasic

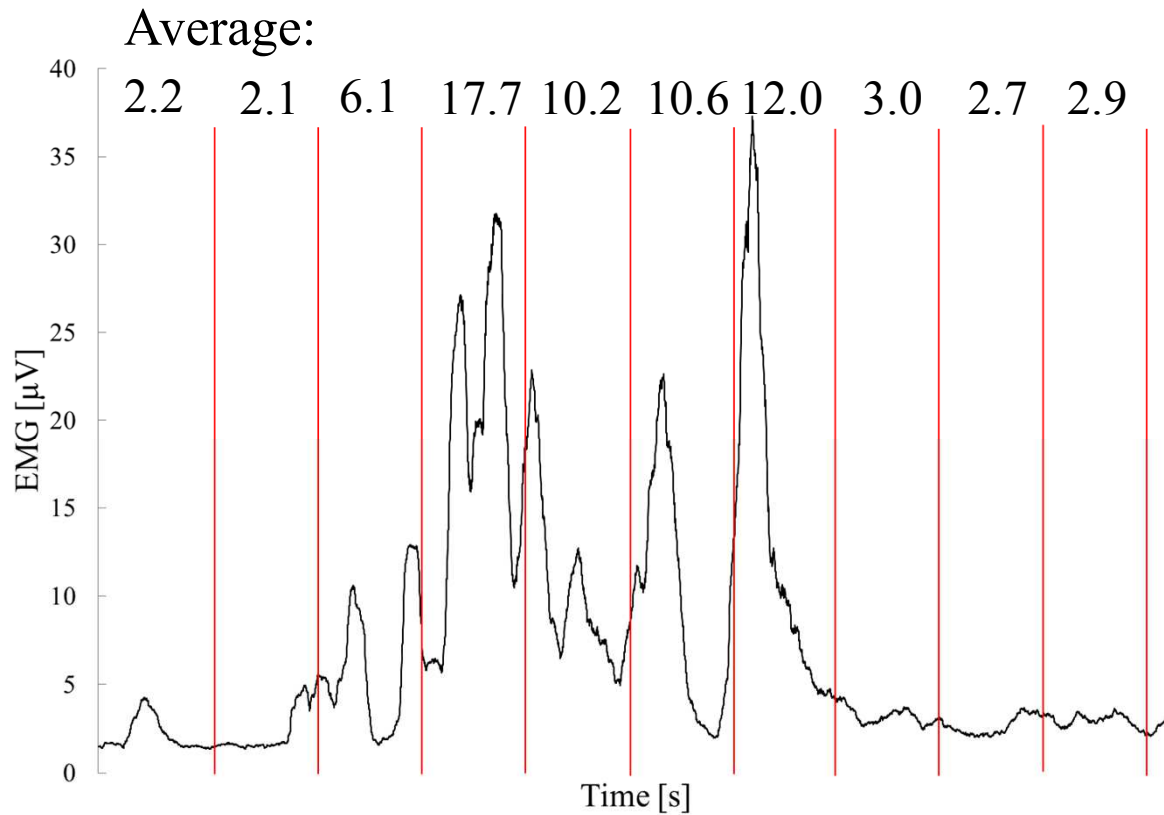①' To extract amplitude during REM Sleep (30s).

② Normalization

③ Rectification smoothing

④ Get average value (P2)

Automatic Algorithm

Derivation algorism of Phasic

① ' To extract amplitude during REM Sleep (30s).

② Normalization
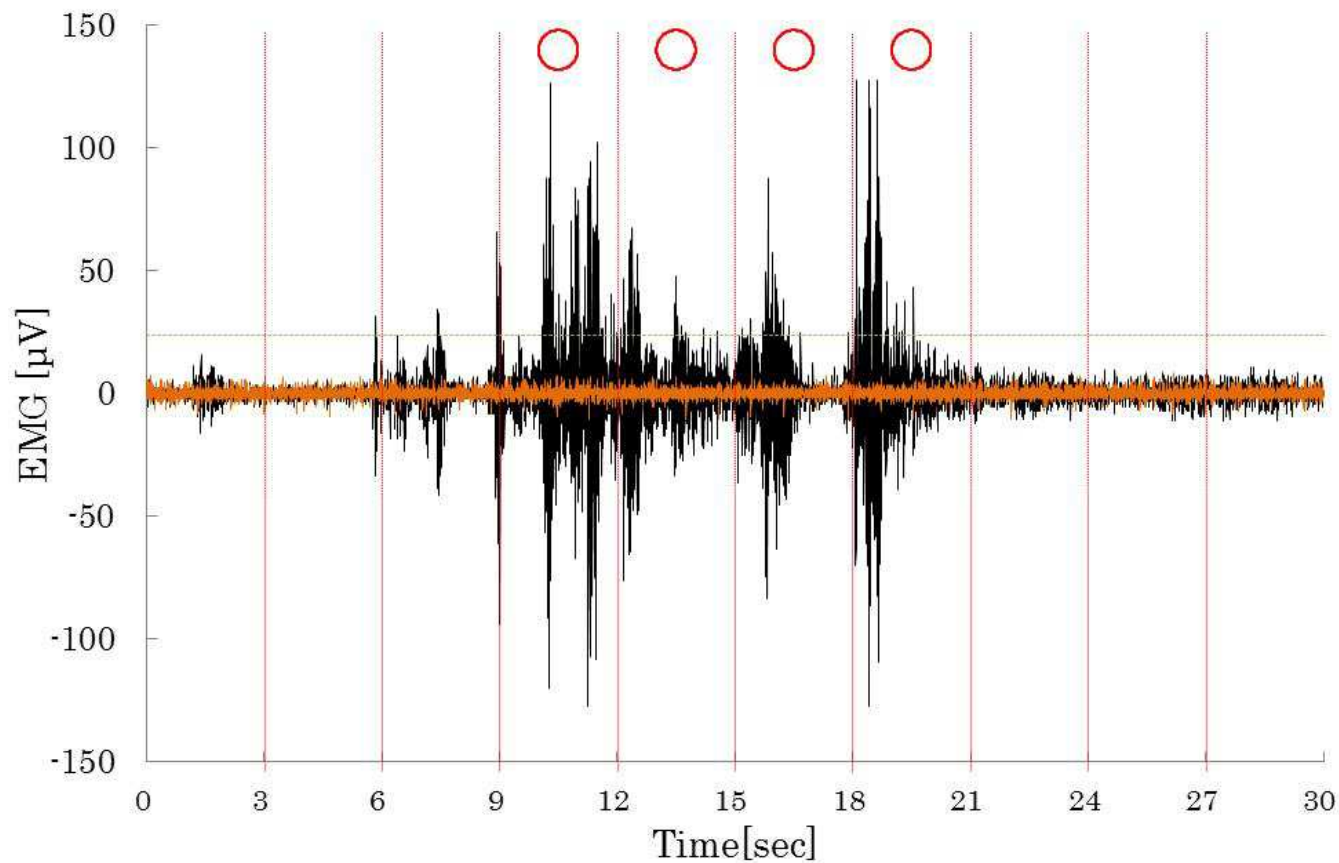
③ Rectification smoothing

④ Get average value (P2)

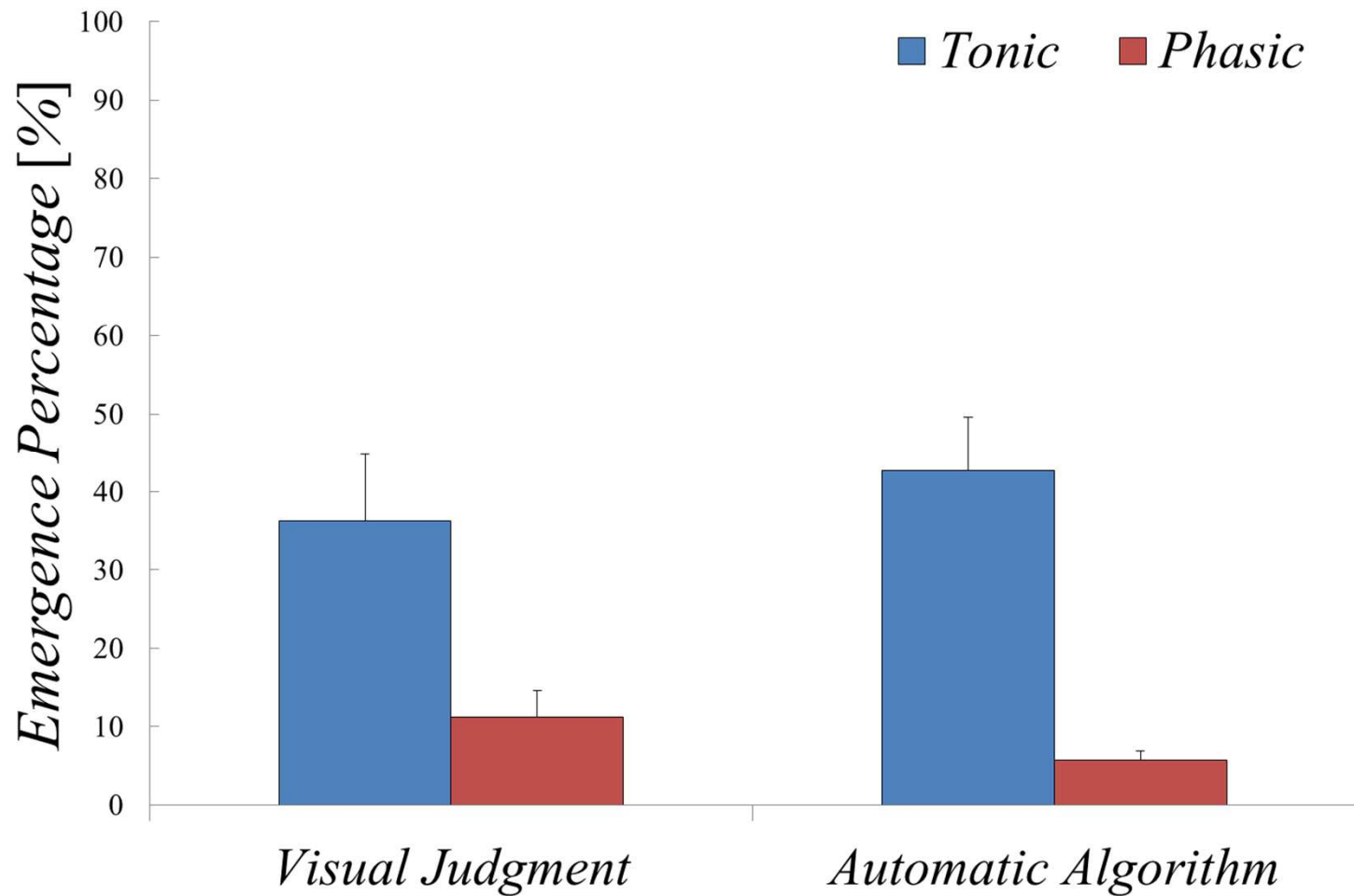# Automatic Algorithm

Derivation algorism of Phasic

If when the average value of P2 is greater than 4 × P1 , determines that the Phasic.

Result (Average ± SE)

There were no significant between Visual Judgment and Automatic Algorithm (p<0.05).

Misclassification rate of each judging method

Next step, we constructed automated algorithms based on the AASM scoring manual, Montplaisir et al., and SINBAR.

Methods

- Subject
  12 patients of the RBD is suspected (72.3 ± 1.7 years)
  13 healthy subjects (40.5 ± 13.2 years)

- Bivariate (Tonic, Phasic) using the Mahalanobis's distance, to discriminate between the two groups (patients, healthy subjects)

Analytical Index

Montplaisir et al.

Component	Epoch	Duration Time	Mini Epoch	Amplitude (µV)
Tonic	20 (s)	10 (s)		Amplitude at least two times the amplitude of the background activity.
Phasic		0.1 - 5.0 (s)	2 (s)	Amplitude at least four times the amplitude of the background activity.

SINBAR

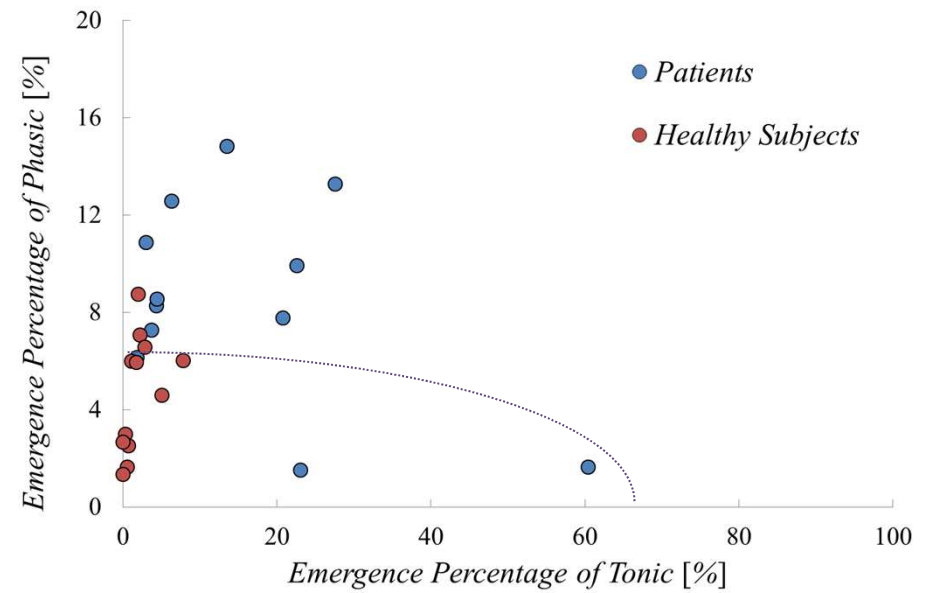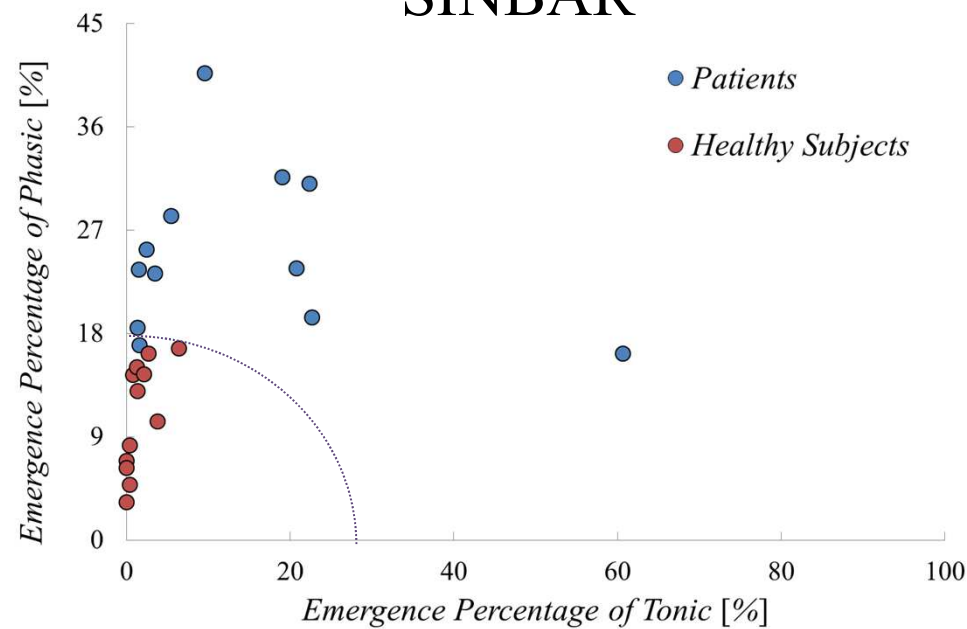| Component	Epoch	Duration Time	Mini Epoch	Amplitude (µV)
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AASM
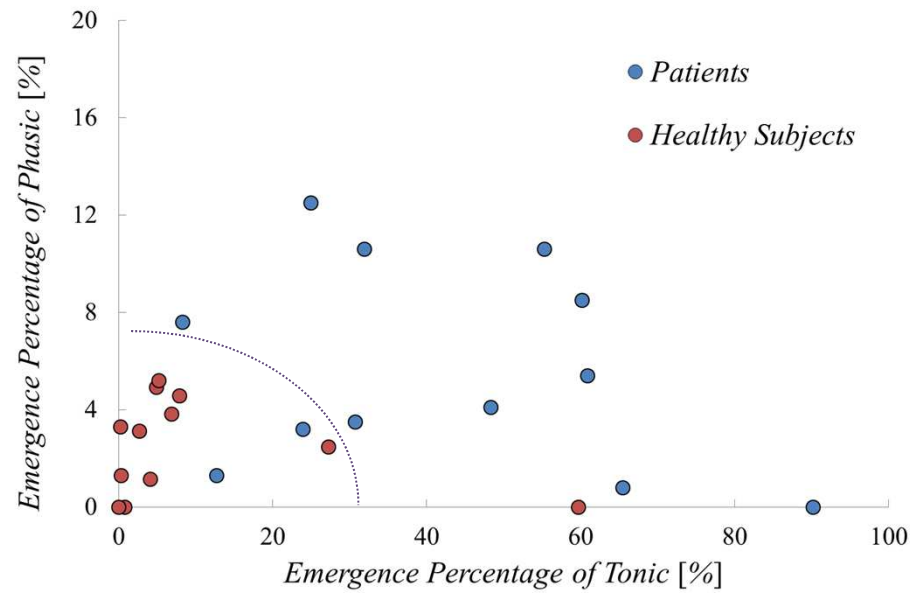
Montplaisir

SINBAR

Number of Misjudgement	AASM	Montplaisir	SINBAR
Patients	2 / 12	3 / 12	1 / 12
Hhealthy Subjects	1 / 13	3 / 13	0 / 13

Conclusion

In this study, we discuss the automatic algorithm to help diagnosing and evaluating severity of a sleep disorder.

In the result, where were no significant between Visual Judgment and Automatic Algorithm (p<0.05)

Next step, the results evaluated by the automated algorithms were compared to the diagnosis by the visual inspection method.

Nonlinear classification analysis was also employed to examine whether the healthy subjects group was significantly different from the group of suspected RBD patients.

The misclassification rate of the SNBAR algorithm was found to be lower than that of the other algorithm