

MODULE

**MULTIPLE SLEEP LATENCY
TEST (MSLT)**

AND

**MAINTENANCE OF
WAKEFULNESS TEST (MWT)**

MULTIPLE SLEEP LATENCY TEST (MSLT) AND MAINTENANCE OF WAKEFULNESS TEST (MWT)

OBJECTIVES:

At the end of this module the student must be able to:

- Know the appropriate indications, normative values and protocols for MSLT/MWT
- Perform MSLT/MWT
- Generate an MSLT/MWT report

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

OBJECTIVES:

- To assess and diagnose disorders of excessive daytime somnolence.
- The MSLT must be performed immediately following polysomnography recorded during the individual's major sleep period.

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

INDICATIONS:

MSLT is indicated to rule out:

- Sleep Apnea
- Movement Disorders
- Circadian Rhythm Disorders
- Insufficient/Poor Sleep
- Other sleep disorders

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PROCEDURE:

- This is a series of four to five “opportunities” for the patient to sleep at a 2 hour interval each nap. The first nap should start 1.5 to 3 hours after awakening the patient from the polysomnogram. The morning after the polysomnogram, the technician is to remove the following:
 - Leg leads
 - Respiratory belts
 - Intercostal EMGs
 - Thermocouple
 - Oximeter
 - Watch/Alarm clock (if applicable)

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PROCEDURE: (cont'd)

- The patient is to change into their daytime clothes. Patient should be informed to bring buttoned down pajama tops and buttoned down t-shirts so as not to cause any damage to the electrodes already in place.
- It is important that the technician NOT wake the patient out of the last REM period of the night because the patient may experience a REM rebound on Nap #1.
- Patients should be asked if they need to go to the bathroom prior to the start of each nap opportunity.

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Conventional Montage

The montage should entail the following:

- 2 EEG leads (a Central and an Occipital)
- 2 Referential leads (M1 and M2)
- 2-4 EOG leads (ROC/M1, LOC/M2 and “optional” RUE/M1, RLE/M1)
- 3 EMG leads (mentalis and 2 submentalis)
- EKG leads

The purpose of the Right Upper Eye and Right Lower Eye is to pick up more questionable Rapid Eye Movements

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Contraindications

- The use of the MSLT to support a diagnosis of Narcolepsy is suspected if TST on the prior night sleep is less than 6 hours.
- The test should not be performed after a split-night study.
- Sleep logs may be acquired for one week prior to the MSLT to assess sleep-wake schedules (sleep hygiene)

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Standardization

- Sleep rooms should be quiet and dark during testing.
- Room temperature should be set based on **patient's comfort level**.
- Smoking should be stopped at least 30 minutes prior to each nap opportunity.
- Vigorous physical activity should be avoided during the day and any stimulating activities by the patient should end at least 15 minutes prior to each nap opportunity.
- Patients must abstain from any caffeinated beverages and avoid unusual exposures to bright sunlight.

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Standardization (cont'd)

- A light breakfast is recommended at least 1 hour prior to the first nap.
- A light lunch is recommended immediately after the termination of the second nap.

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Medications

- Stimulants, stimulant-like medications, and REM suppressing medications should be ideally stopped 2 weeks before the MSLT.
- Use of the patient's other usual medications (anti-hypertensives, insulin, etc.) should be thoughtfully planned by the sleep clinician before MSLT testing so that undesired influences by stimulating or sedating properties of medications are minimized.
- Sleep technologists who perform the MSLT should be experienced in conducting the test.

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Patient Calibrations:

The Patient Calibrations should be performed prior to commencing each nap. This is done to ensure the integrity of the electrodes and to correct any problems that may have occurred in between naps. Impedances should always be checked prior to each nap as well.

“Mr./Ms._____ please keep your eyes open for approximately 30 seconds.”

(note: Eyes Open)

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Patient Calibrations: (cont'd)

“Without moving your head, using only your eyes, please look to the Right, Left, Right, Left.” (note: Look Right-Left-Right-Left)

“Again, without moving your head, using only your eyes, please look up towards your forehead, now down towards your feet, look back up again and back down (note: Look Up-Down)

“Now slowly and distinctly, please blink your eyes five times.” (note: Blink x5)

“Grit your teeth...and relax.” (note: Grit teeth)

“Now close your eyes for approximately 30 seconds and I'll be in shortly.” (note: Eyes closed)

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Performance:

- Have the patient complete the Pre-Nap Questionnaire (see attached). Once this is completed then you can commence the nap.
- Instruct the patient to “lie quietly and do whatever comes naturally.”
- Turn off lights and start the test.
- If the patient does not sleep, you are to run the nap for 20 minutes or 40 epochs. If during this 20-minute time frame the patient falls asleep, you are to run the nap for 15 minutes or 30 epochs from the point where the patient fell asleep.

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Pre-Nap Questionnaire

- (1) Feeling active and vital, alert, wide awake
- (2) Functioning at a high level, but not at peak, able to concentrate
- (3) Relaxed and awake, not at full alertness, responsive
- (4) A little foggy, let down
- (5) Fogginess, beginning to lose interest in remaining awake
- (6) Sleepiness, prefer to be lying down, fighting sleep, woozy
- (7) Almost in reverie, sleep onset soon, losing struggle to remain awake

Nap #1: _____

Nap #2: _____

Nap #3: _____

Nap #4: _____

Nap #5: _____

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Procedure

- If the patient gets into REM during this 15-minute time frame, you are to end the nap at the end of the 15th minute of sleep.
- On the Technician Report Form, you are to compute the Sleep and REM Latencies (if applicable). If the patient does not sleep, you are to put as a Sleep Latency time of 20 minutes.
- To compute Sleep Latency, you would calculate “Sleep Onset Epoch – Lights Out Epoch” then divide by 2.
- To compute REM Latency you would calculate “REM Onset Epoch – Sleep Onset Epoch ” then divide by 2.

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Procedure (cont'd)

- At the end of each nap, have the patient complete the Post-Nap Questionnaire (see attached). Disconnect the jack box and inform the patient that he must stay out of the bed and remain awake until the next nap commences.
- To calculate for the Mean Sleep Latency, you would add up all of the Sleep Latencies then divide by the number of naps.

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Post-Nap Questionnaire

	Nap 1	Nap 2	Nap 3	Nap 4	Nap 5
Did you sleep? Y/N					
How long did you sleep?					
Did you dream? Y/N					
How long did it take you to fall asleep?					

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

DIAGNOSIS:

- To be diagnosed as Narcoleptic, the patient would have to demonstrate a Mean Sleep Latency (an average of all the sleep latencies) of 5.0 minutes or less and demonstrate at least 2 Sleep Onset REM Periods (SOREMP).
- The primary clinical features of Narcolepsy are:
 - Excessive Daytime Somnolence
 - Sleep Paralysis
 - Hypnagogic Hallucinations
 - Cataplexy
- Not all four of the Narcolepsy Tetrad are experienced by the patient. Generally, two of the four features.

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Nap #1

- Lights Out at 9:00 am
- If no sleep, you would end the nap at: (1)_____
- Sleep onset occurred at 9:06 am
- Sleep latency is: (2)_____ minutes
- Lights On at: (3)_____

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Answer: Nap #1

- Lights Out at 9:00 am
- If no sleep, you would end the nap at: 9:20 am
- If Sleep onset occurred at 9:06 am
- Sleep latency is: 6 minutes
- Lights On at: 9:21 am

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

How to derive the answers?

Remember the rules:

(1) if ***no sleep*** occurs, run the nap for **20** minutes

(2) Sleep Latency is computed using the formula:

Sleep Onset Time (9:06) - Lights Out Time (9:00)

(3) Lights On will be **15** minutes after the ***sleep onset***

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Nap #2

- Lights Out at: (1)_____ am
- Sleep onset occurred at 11:03 am
- Sleep latency was: (2)_____ minutes
- Wake observed at 11:04 am
- Lights On at: (3)_____ am

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Answer: Nap #2

- Lights Out at: **11:00 am**
- Sleep onset occurred at 11:03 am
- Sleep latency was: **3 minutes**
- Lights On at: **11: 18 am**

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

How to derive the answers?

Remember the rules:

(1) the naps will be run on a **2-hour** interval

(2) Sleep Latency is computed using the formula:

Sleep Onset Time (11:03) - Lights Out Time (11:00)

(3) Lights On will be **15** minutes after the **sleep onset**

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Nap #3

- Lights Out at: (1)_____ pm
- Sleep onset occurred at 1:00 pm
- Sleep latency was: (2)_____ minutes
- REM onset occurred at 1:02 pm
- REM latency was: (3)_____ minutes
- Lights On at: (4)_____ pm

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Answer: Nap #3

- Lights Out at: 1:00 pm
- Sleep onset occurred at 1:00 pm
- Sleep latency was: 0 minutes
- REM onset occurred at 1:02 pm
- REM latency was: 2 minutes
- Lights On at: 1:15 pm

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

How to derive the answers?

Remember the rules:

(1) the naps will be run on a **2-hour** interval

(2) Sleep Latency is computed using the formula:

Sleep Onset Time (1:00) - Lights Out Time (1:00)

(3) REM Latency is computed using the formula:

REM onset Time (1:02) – Sleep Onset Time (1:00)

(4) Lights On will be **15** minutes after the **sleep onset**

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Nap #4

- Lights Out at: (1)_____ pm
- Sleep was not observed
- Sleep latency would be: (2)_____ minutes
- Lights On at: (3)_____ pm

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Answer: Nap #4

- Lights Out at: 3:00 pm
- Sleep was not observed
- Sleep latency would be: 20 minutes
- Lights On at: 3:20 pm

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

How to derive the answers?

Remember the rules:

- (1) the naps will be run on a **2-hour** interval
- (2) if **no sleep**, run the nap for **20** minutes
- (3) Lights On will also be after 20 minutes since no sleep was achieved

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Nap #5

- Lights Out at epoch 350
- Sleep onset occurred at epoch 355
- Sleep latency was: (1)_____ minutes
- REM onset occurred at epoch 365
- REM latency was: (2)_____ minutes
- Lights On at epoch: (3)_____

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Answer: Nap #5

- Lights Out at epoch 350
- Sleep onset occurred at epoch 355
- Sleep latency was: **2.5 minutes**
- REM onset occurred at epoch 365
- REM latency was: **5 minutes**
- Lights On at epoch: **385**

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

How to derive the answers?

Remember the rules:

(1) Sleep Latency is computed using the formula:

$\text{Sleep Onset Epoch (355)} - \text{Lights Out Epoch (350)} \div 2$
(to convert epoch to minutes)

(2) REM Latency is computed using the formula:

$\text{REM Onset Epoch (365)} - \text{Sleep Onset Epoch (355)} \div 2$
(to convert epoch to minutes)

(3) Lights On will also be after 30 epochs or 15 minutes from sleep onset.

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

Calculation for Mean Sleep Latency

Add all of the sleep latencies
(including No Sleep of 20 minutes)
and divide by the number of naps

Example

Nap #1: 6.0 minutes

Nap #2: 3.0 minutes

Nap #3: 0.0 minutes

Nap #4: 20.0 minutes

Nap #5: 2.5 minutes

$$31.5 \text{ minutes} \div 5 = 6.3 \text{ minutes}$$

Mean Sleep Latency

LESSON 1: MULTIPLE SLEEP LATENCY TEST (MSLT)

On this lesson you have learned the standard procedure and protocols on how to conduct an MSLT. You have also learned how to generate an MSLT report.

Next lesson will be the Maintenance of Wakefulness Test.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

The Maintenance of Wakefulness Test (MWT) is an evaluation used as a quantitative polysomnographic (PSG) measurement of daytime wakefulness/somnolence during soporific circumstances. The assessment of such disorders requires a polygraphic approach, in which multiple physiologic parameters are recorded during overnight evaluation followed the next day by 4 scheduled test periods.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

MWT Protocols

- 4-trial MWT 40-minute protocol is recommended @ 2 hour intervals.
- First trial begins 1.5 to 3 hours after the patient's usual wake-up time.
- Performance of a PSG prior to MWT should be decided by the clinician based on clinical circumstances.
- Sleep logs prior to MWT may be used based on clinical judgment.
- Room should be maximally insulated from external light.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

MWT Protocols (cont'd)

- Light source should be positioned slightly behind patient's head (out of field of vision) with an illuminance of 0.10-0.13 lux at the corneal level (i.e. 7.5 watt light)
- Room temperature should be set based on the patient's comfort level.
- Patient should be seated in bed, with the back & head supported by a bedrest/bolster pillow such that the neck is not uncomfortably flexed or extended.
- Use of tobacco, caffeine and other medications by the patient before and during MWT should be addressed and decided upon by the sleep clinician before MWT.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

MWT Protocols (cont'd)

- Drug screening may be indicated to ensure that sleepiness/wakefulness on the MWT is not influenced by substances other than medically prescribed drugs.
- Sleep technologists who perform the MWT should be experienced in conducting the test.
- Conventional recording montage should be utilized.
- Prior to each trial, patient should be asked if they need to go to the bathroom.
- Standard instructions for Bio-cals should be performed prior to each trial.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

MWT Protocols (cont'd)

- Instruct the patient “Please sit still and remain awake for as long as possible.” Look directly ahead of you, and do not look directly at the light.
- Patients are not allowed to use extraordinary measures to stay awake such as slapping the face or singing.
- Trials are ended after 40 minutes if no sleep occurs, or after unequivocal sleep, defined as three consecutive epochs of stage 1 sleep or one epoch of any other stage of sleep.
- Start/Stop times for each, Sleep latency, TST, Stages of sleep achieved for each trial, and the mean sleep latency should be recorded.

LESSON 2: MAINTENANCE OF WAKEFULNESS TEST (MWT)

On this lesson you have learned the protocols for conducting MWT.

MULTIPLE SLEEP LATENCY TEST (MSLT) AND MAINTENANCE OF WAKEFULNESS TEST (MWT)

Reference

- AASM Practice Parameter: Practice Parameters for Clinical Use of the Multiple Sleep Latency Test and the Maintenance of Wakefulness Test, *Sleep*, Vol. 28, No. 1, 2005.