RUHANI COLLEGE OF MASSAGE THERAPY

RU RMT 24 · NEUROLOGY 3

Student Handout

Lecture 02 — Integrative Cerebral Functions

Consciousness · Sleep · Learning · Memory — and what each means for treatment planning

- Builds on the reticular formation, hypothalamus and cortical organisation taught in RU RMT 16 (Neurology 2)
- Covers the sleep disorders and fatigue states most often seen in massage therapy practice
- Applies memory science directly to consent, client education and home-care design
- Clinical reference: Rattray & Ludwig, Clinical Massage Therapy (Talus, 2000) — stress and fatigue entries

How to use this handout

- This handout carries the full content of the lecture in the same order as the slides, so you can follow along without transcribing.
- Headings match the slide titles exactly. Use the wide left margin for your own notes.
- Anything marked MASSAGE THERAPY APPLICATION is the clinical consequence of the material above it — that is what you are being examined on.
- Reference lines give the source. Rattray refers to Rattray & Ludwig, Clinical Massage Therapy (Talus, 2000); CMTO links go to the current Standards of Practice.

THIS LECTURE

Learning Outcomes

By the end of Lecture 2, the student will be able to:

- Describe the neuroanatomy of wakefulness — the hypothalamus, the pineal gland and the reticular activating system.
- Differentiate NREM and REM sleep and describe the autonomic changes that occur across a night of sleep.
- Explain how the physiology of the relaxation response mirrors the physiology of sleep onset.
- Recognise insomnia, obstructive sleep apnea, narcolepsy, restless legs syndrome and chronic fatigue syndrome, and state the massage therapy implications of each.
- Explain learning and neuroplasticity, the three phases of memory, and long-term potentiation.
- Distinguish anterograde from retrograde amnesia and identify memory findings that require referral.
- Design home-care instruction that respects the demonstrated limits of working memory.
- Apply the Health Care Consent Act, 1996 and CMTO consent requirements when a client's memory or capacity is impaired.

REVIEW LINK

What Neurology 2 Established

Structures you already know

- The reticular formation runs through the brainstem and gives rise to the reticular activating system.
- The hypothalamus is the master autonomic and endocrine integrator.
- The epithalamus contains the pineal gland.
- The hippocampus, within the temporal lobe and limbic system, is central to memory formation.
- The thalamus relays all sensory input except olfaction to the cortex.

What this lecture adds

- How those structures produce the states of consciousness, from full alertness to coma.
- The architecture of a night of sleep and what fails in each sleep disorder.

- The cellular mechanism of memory — long-term potentiation — and its clinical use.
- How each of these translates into a treatment environment, a session length and a home-care plan.

CONSCIOUSNESS

Levels of Consciousness and Their Terminology

Consciousness has two components: arousal (being awake) and awareness (content of thought). The reticular activating system supplies the first; the cortex supplies the second.

The scale

- Alert — fully awake, oriented and responsive.
- Lethargic — drowsy, rousable, falls back to sleep when left alone.
- Obtunded — reduced alertness, slow responses, requires repeated stimulation.
- Stupor — responds only to vigorous or noxious stimulation.
- Coma — no arousal and no purposeful response to any stimulus.

Why an RMT should know this

- It gives you precise, objective vocabulary for documentation instead of "seemed out of it".
- A change in level of consciousness during or after a treatment is an emergency finding.
- Sleep is distinguished from coma by one feature: a sleeping person can be roused.
- Any client who cannot be roused normally after a treatment requires emergency services, not a second attempt.

CONSCIOUSNESS

Orientation and the Glasgow Coma Scale

Orientation

- Assessed to person, place, time and situation — recorded as "oriented x 4".
- Disorientation typically fails in that order: time first, then place, then person.
- Useful when screening after a head injury, in a client with dementia, or in an acute event on the table.

Glasgow Coma Scale — awareness only

- Scores eye opening (1–4), verbal response (1–5) and motor response (1–6); total 3 to 15.
- 13–15 mild, 9–12 moderate, 8 or below severe.
- RMTs do not score the GCS clinically, but you will read it in medical records and referral letters and should understand what the number means.
- A client's documented GCS at the time of injury is relevant history when planning post-concussion or post-TBI care.

WAKEFULNESS

Circadian Rhythm and Its Control

- A circadian rhythm is an approximately 24-hour internal cycle governing sleep–wake timing, core temperature, cortisol release and alertness.
- The master clock is the suprachiasmatic nucleus of the hypothalamus, entrained by light arriving through the retinohypothalamic tract.
- The suprachiasmatic nucleus drives the pineal gland, which secretes melatonin: secretion rises in darkness and is suppressed by light.
- Cortisol follows the opposite curve, peaking shortly after waking and falling through the day.
- Core body temperature falls at night and reaches its lowest point in the early hours — one reason clients feel cold on the table late in the day.
- Shift work, jet lag, irregular schedules and evening screen light all desynchronise the cycle.

MASSAGE THERAPY APPLICATION

– Shift workers and new parents present with fatigue, generalised muscle aching and heightened pain sensitivity that has no local tissue cause. Record the sleep pattern in the history — it explains the presentation.

WAKEFULNESS

The Reticular Activating System

Structure and function

– A diffuse network of neurons in the brainstem reticular formation with projections to the thalamus, cortex, cerebellum and spinal cord.
– Sets and alters the level of consciousness and arousal.
– Filters incoming sensory information — pain, touch, temperature, sound and light — deciding what reaches conscious attention.
– Activation produces a general increase in cortical firing: wakefulness and alertness.
– Reduced activity allows the transition to drowsiness and sleep.

What activates it

– Pain and any noxious stimulus.
– Bright or changing light.
– Sudden, loud or unpredictable sound.
– Cold, and any thermal discomfort.
– Novelty of any kind — an unfamiliar room, therapist or sequence.
– Anxiety and anticipation, through limbic input.

MASSAGE APPLICATION

The Treatment Room as an RAS Variable

The relaxation response is not produced by technique alone. Half of it is produced by removing the stimuli that keep the reticular activating system active.

What lowers arousal

– Warmth — a warm room, warm hands, warm linens. Cold is a reliable arousal stimulus.
– Low, indirect, steady light.
– Predictable sound: quiet, or steady low-level sound with no sudden changes.
– Rhythmic, continuous contact with no unexpected breaks.
– A sequence the client already knows, delivered by the same therapist.
– Explaining what will happen next before it happens.

What raises it and undoes the work

– Pressure that crosses into pain — the single most effective way to abolish relaxation.
– Sudden first contact with no warning.
– Talking that requires the client to think and answer.
– Doors, phones, corridor noise, temperature swings.
– Frequently changing the plan mid-session without explanation.

Fritz, S. (2021). Mosby's Fundamentals of Therapeutic Massage (7th ed.). Elsevier.

SLEEP

Sleep: Definition and Function

– Sleep is a state of altered consciousness or partial unconsciousness from which the individual can be aroused — the feature that distinguishes it from coma.

- Two states alternate through the night: non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep.
- Sleep supports tissue repair: growth hormone release peaks during deep NREM sleep.
- It supports immune function, with cytokine activity following the sleep cycle.
- It consolidates memory, transferring the day's encoding into durable long-term storage.
- It clears metabolic waste from the central nervous system through the glymphatic system, which is far more active during sleep than in waking.

SLEEP

NREM Sleep — the Three Stages

Progression

- N1 — the transition from wake to sleep; lasts a few minutes; easily roused; hypnic jerks may occur.
- N2 — light sleep; heart rate and temperature fall; occupies roughly half of total sleep time.
- N3 — slow-wave or deep sleep; the most restorative stage; hardest to rouse from; where growth hormone release and physical repair are concentrated.

Features throughout NREM

- Little or no eye movement.
- Skeletal muscles are not paralysed — postural adjustment and movement are possible.
- Dreaming is uncommon and, when it occurs, is fragmentary rather than narrative.
- Sleepwalking, night terrors and bruxism arise from N3, not from REM.
- N3 dominates the first half of the night.

SLEEP

REM Sleep and Muscle Atonia

Characteristics

- Rapid eye movements beneath closed lids.
- The principal stage for vivid narrative dreaming.
- Cortical activity resembles waking; heart rate and respiration become irregular.
- Skeletal muscles are actively paralysed — REM atonia.
- Exceptions that stay active: the extraocular muscles, the diaphragm and respiratory muscles, and the muscles of the pharynx to a limited degree.

Why atonia matters

- It prevents us from physically acting out dream content.
- Loss of atonia produces REM sleep behaviour disorder, in which the person moves and can injure themselves or a bed partner.
- Reduced pharyngeal tone during REM worsens obstructive sleep apnea, which is why apneic events cluster in REM.
- REM periods lengthen toward morning, so the last hours of sleep carry the most REM.

SLEEP

The Architecture of a Night

- A complete cycle takes roughly 90 minutes, and a typical night contains four to six cycles.
- Deep N3 sleep is concentrated in the first two cycles; by the second half of the night there may be almost none.
- REM periods start short and lengthen with each cycle, so most REM occurs in the final third of the night.
- This is why cutting sleep short by two hours removes a disproportionate amount of REM rather than an even slice of everything.

- Brief awakenings between cycles are normal and are usually not remembered.
- Total sleep requirement for most adults is seven to nine hours; the requirement does not fall with habituation, only the perception of impairment does.

MASSAGE THERAPY APPLICATION

- A client who says they wake at four in the morning and cannot get back to sleep is losing the REM-rich portion of the night — a pattern associated with mood disturbance and worth noting in the history.

SLEEP

Sleep and the Autonomic Nervous System

- Across all stages of sleep the parasympathetic division takes over, reducing heart rate, blood pressure and respiratory rate.
- Parasympathetic dominance supports tissue repair, digestion, restorative processes and energy conservation.
- Sympathetic tone falls, and with it overall resting muscle tone eases.
- Blood pressure normally dips by ten to twenty per cent overnight; failure of this nocturnal dip is associated with cardiovascular risk.
- REM sleep is the exception: autonomic activity becomes irregular and surges occur, which is why cardiac events cluster in the early morning.

MASSAGE THERAPY APPLICATION

- The physiological signature of relaxation-focused massage — falling heart rate, falling blood pressure, slower breathing, reduced tone — is the same signature as sleep onset. That is not a coincidence; it is the same autonomic shift.

MASSAGE APPLICATION

Massage and the Parasympathetic Shift

What can be claimed

- Massage therapy is associated with a shift in autonomic balance toward parasympathetic dominance during and shortly after treatment.
- Clients commonly report improved sleep quality following relaxation-focused treatment.
- Reducing musculoskeletal pain removes one of the principal barriers to falling and staying asleep.
- Clients frequently fall asleep on the table — a normal sign, not a sign of a poorly judged session.

How to describe it in scope

- Describe effects in evidence-informed terms, matched to the individual, as required by the Standard of Practice on Client-centred Care.
- Do not claim massage treats insomnia or apnea. It supports sleep by reducing pain, tension and arousal.
- Do not offer sleep-hygiene advice as though it were a prescription; general education within scope is appropriate, diagnosis and treatment of a sleep disorder is not.
- Record what the client reports about sleep at each visit — it is a legitimate and measurable outcome.

CMTO Standard of Practice: Client-centred Care — https://www.cmto.com/rules/client-centred-care/

SLEEP

Sleep Deprivation — Physiological Effects

- Reduced attention, reaction time, working memory and decision quality — impairment comparable to alcohol intoxication at severe levels.
- Reduced pain threshold and pain tolerance: a sleep-deprived person genuinely hurts more from the same stimulus.
- Impaired tissue healing, reduced growth hormone release and blunted immune response.
- Aching muscles, headache, tremor, irritability and, at extremes, confusion and hallucination.

- Increased sympathetic tone, blood pressure and inflammatory markers.
- Appetite dysregulation through leptin and ghrelin, with associated metabolic consequences.

MASSAGE THERAPY APPLICATION

- When a client reports that everything hurts more than it used to and nothing has changed physically, ask about sleep before assuming a new pathology. Poor sleep is a genuine amplifier of pain.

Werner, R. (2019). A Massage Therapist's Guide to Pathology (7th ed.). Books of Discovery.

MASSAGE APPLICATION

Therapist Self-Care and Fatigue

The CMTO career-span competencies include maintaining personal wellness consistent with the needs of practice. This is a professional obligation, not a lifestyle suggestion.

Risk to you

- Fatigue degrades body mechanics first — the therapist compensates with wrist, thumb and lumbar strain.
- Reduced proprioceptive acuity means poorer palpation and less accurate pressure judgment.
- Impaired attention means missed red flags in the history and on assessment.
- Repetitive strain injury risk rises with accumulated fatigue across a full clinic week.

Risk to the client

- A tired therapist misjudges pressure on an insensate or sensitised client.
- Fatigue erodes the consistency and predictability that produce the relaxation response.
- Documentation quality falls at the end of a long day, and records are a regulatory requirement.
- Schedule design, breaks and treatment-room ergonomics are part of safe practice, not indulgence.

CMTO Standard of Practice: Safety and Risk Management — https://www.cmto.com/rules/standard-of-practice-safety-and-risk-management/

SLEEP DISORDERS

Insomnia

Presentation

- Difficulty falling asleep, staying asleep, or waking too early and being unable to return to sleep.
- The person wakes unrefreshed — non-restorative sleep — regardless of hours in bed.
- Acute insomnia is situational and short-lived; chronic insomnia persists three nights a week for three months or more.
- Contributing factors: stress, anxiety, pain, caffeine, alcohol, irregular schedule, and poor sleep environment.
- A vicious cycle develops: worry about sleep becomes an arousal stimulus that prevents sleep.

Massage therapy considerations

- Massage is indicated as supportive care and is very well tolerated.
- The strongest contribution is removing musculoskeletal pain that fragments sleep.
- Book relaxation-focused sessions at a consistent time; predictability is part of the effect.
- General education on sleep environment is within scope; treating the disorder is not.
- Persistent or severe insomnia warrants referral to a physician — diagnosis lies outside the RMT scope.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Stress Reduction.

TREATMENT PLANNING

Insomnia — Building the Plan

Goals and technique

- Goal: reduce sympathetic arousal and the musculoskeletal pain that interrupts sleep.

- Slow, rhythmic Swedish techniques with long continuous strokes and minimal variation.
- Sustained gentle work on the suboccipitals, cervical paraspinals, scalenes and upper trapezius.
- Diaphragmatic and lower rib work to support slower, deeper breathing, with consent.
- Avoid tapotement, vigorous friction and any technique that surprises.

Dosage and home care

- Longer, less frequent sessions generally outperform short frequent ones for this goal.
- Late-afternoon or evening appointments align the effect with the sleep window where scheduling allows.
- Home care: two items only — a breathing practice and one positional stretch, both brief.
- Outcome measures: reported sleep onset time, number of night wakings, and morning stiffness.
- Reassess at the fourth visit; if there is no change, review the referral question.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Stress Reduction.

SLEEP DISORDERS

Obstructive Sleep Apnea

Pathophysiology and presentation

- Repeated cessation of airflow for ten seconds or more, many times per hour, despite continued respiratory effort.
- Caused by loss of pharyngeal muscle tone during sleep, allowing the upper airway to collapse.
- Produces loud snoring, witnessed breathing pauses, gasping arousals and fragmented sleep.
- Daytime consequences: severe sleepiness, morning headache, poor concentration and irritability.
- Associated with hypertension, arrhythmia, stroke risk and type 2 diabetes.
- Central sleep apnea, in which respiratory effort itself ceases, is less common and neurologically driven.

Massage therapy considerations

- Screen in the health history: snoring, witnessed pauses, morning headache, daytime sleepiness.
- Prolonged flat supine positioning can worsen airway obstruction — elevate the head or use a side-lying position if the client reports difficulty.
- Expect the client to fall asleep quickly and to be difficult to rouse; wake gently and allow time before sitting up.
- Clients using CPAP often present with facial and jaw discomfort from the mask — this is treatable within scope.
- Refer for medical assessment; diagnosis and management are outside the RMT scope.

Werner, R. (2019). A Massage Therapist's Guide to Pathology (7th ed.). Books of Discovery.

SLEEP DISORDERS

Narcolepsy, Hypersomnia and Parasomnias

Narcolepsy and hypersomnia

- Narcolepsy: chronic daytime sleepiness with sudden, irresistible sleep attacks; associated with loss of hypothalamic orexin-producing neurons.
- Cataplexy — sudden bilateral loss of muscle tone triggered by strong emotion, most often laughter — accompanies type 1 narcolepsy.
- Sleep paralysis and hypnagogic hallucinations reflect REM intruding into wakefulness.
- Idiopathic hypersomnia: excessive sleep with no restorative benefit and severe sleep inertia on waking.

Parasomnias and movement disorders of sleep

- Restless legs syndrome: an irresistible urge to move the legs, worse at rest and in the evening, relieved by movement. Associated with iron deficiency and pregnancy.
- Periodic limb movement disorder: repetitive limb jerks fragmenting sleep without the person's awareness.
- Bruxism: nocturnal clenching and grinding, presenting as masseter and temporalis hypertonicity and jaw pain.

– Night terrors and sleepwalking arise from deep N3 sleep, most often in children.

MASSAGE THERAPY APPLICATION

– Restless legs and bruxism are the two most commonly encountered in practice, and both present with treatable soft tissue findings — the legs and the muscles of mastication respectively.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Temporomandibular Joint Dysfunction.

FATIGUE STATES

Chronic Fatigue Syndrome / Myalgic Encephalomyelitis

Presentation

– Persistent, disabling fatigue lasting six months or more in adults, not explained by exertion or another condition, and not relieved by rest.

– Post-exertional malaise: a disproportionate worsening of all symptoms after physical or cognitive effort, often delayed by 12 to 48 hours.

– Unrefreshing sleep despite adequate duration.

– Cognitive impairment — impaired memory, concentration and word finding.

– Widespread muscle and joint pain without swelling or redness; orthostatic intolerance is common.

– Cause is not established; onset frequently follows a viral illness.

The governing principle

– Post-exertional malaise means that treatment which feels tolerable during the session can produce a severe delayed flare.

– Do not treat to tolerance. Treat well below it and let the response over the following two days guide the next session.

– Shorter sessions — thirty minutes or less initially — are appropriate and clinically correct, not a lesser service.

– Graded exercise prescription is contraindicated in this population and is outside the RMT scope in any case.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Chronic Fatigue Syndrome.

TREATMENT PLANNING

Chronic Fatigue — Pacing as the Core of the Plan

Session design

– Begin at thirty minutes, light pressure, one or two regions only.

– Goal: parasympathetic support and symptom relief — not tissue change and not restoring function in one session.

– Use slow effleurage and static holds; avoid deep specific work, vigorous friction and extended range-of-motion work.

– Keep the room warm and allow generous time to rise from the table.

– Schedule so the client is not travelling far or immediately returning to work.

Monitoring and progression

– Ask specifically about the 24 to 48 hours after the previous session, not about how it felt at the time.

– Progress duration before you progress pressure, and change only one variable per session.

– A flare means the previous dose was too high; reduce rather than persist.

– Home care is rest-positioning and breathing, not exercise.

– Document the dose given and the delayed response — this record is the treatment plan.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Chronic Fatigue Syndrome.

LEARNING

Learning and Neuroplasticity

- Learning is the acquisition of new skills, abilities and information through instruction and experience.
- The brain changes physically as learning occurs — this capacity is neuroplasticity.
- Synaptic plasticity: existing synapses strengthen or weaken according to how they are used.
- Structural plasticity: new dendritic spines and new synaptic connections form.
- Cortical remapping: the area of cortex devoted to a body part or a skill expands with use and contracts with disuse.
- Plasticity is greatest in childhood but continues throughout life — the basis of adult rehabilitation.
- It is not inherently beneficial: maladaptive plasticity produces persistent pain, learned guarding and phantom limb sensation.

LEARNING

What Plastic Change Requires

The four conditions

- Repetition — a single exposure changes very little; sustained repetition changes structure.
- Attention — movement performed without attention produces far less cortical change than the same movement performed deliberately.
- Relevance — tasks the person values and can see the point of produce more change than abstract exercises.
- Feedback — knowledge of results guides the refinement of the movement.

What this means for practice

- A weekly passive treatment supplies repetition at far too low a frequency to drive plastic change on its own.
- The home-care programme is where the repetition happens; it is the active ingredient of any rehabilitative plan.
- Teaching a movement badly and having it repeated daily embeds the error — demonstrate and check before sending it home.
- Postural re-education is motor learning: it needs cues the client can apply in daily life, not a diagram.

MEMORY

Memory: Definition and Three Phases

Memory is the process by which information is encoded, stored and later retrieved. To become a lasting memory, an experience must produce structural change in the brain.

The three phases

- Sensory memory — holds ongoing sensory experience for a few seconds; enormous capacity, near-instant decay.
- Working (short-term) memory — holds roughly seven items for seconds to minutes; requires rehearsal to persist.
- Long-term memory — durable storage lasting days to a lifetime; effectively unlimited capacity.

Moving between them

- Attention transfers sensory memory into working memory; without attention the information is simply lost.
- Rehearsal, meaning and emotional salience transfer working memory into long-term memory.
- Consolidation continues after learning, particularly during sleep.
- Retrieval is itself reconstructive — each recall subtly alters the stored memory.

MEMORY

Working Memory and Chunking

Capacity and limits

- Working memory holds approximately seven items, plus or minus two; more recent work suggests four is a more realistic figure for unfamiliar material.

- Duration without rehearsal is fifteen to thirty seconds.
- Chunking — grouping items into meaningful units — increases effective capacity: a phone number is remembered as three chunks, not ten digits.
- Divided attention, anxiety, pain, fatigue and medication all reduce available working memory.

The clinical consequence

- A client at the end of a treatment is warm, drowsy and parasympathetically dominant — the worst possible state for encoding new information.
- Verbal home-care instructions given at that moment are very largely lost before the client reaches the car.
- Pain and anxiety further reduce capacity, so the clients who most need the instruction retain it least.
- This is a physiological limit, not a matter of client motivation.

MEMORY

Long-Term Memory and Long-Term Potentiation

Types of long-term memory

- Declarative (explicit) — facts and events; requires the hippocampus for formation.
- Semantic — general knowledge; episodic — personal events.
- Non-declarative (implicit) — procedural skills, conditioning and priming; depends on the basal nuclei and cerebellum rather than the hippocampus.
- Procedural memory is remarkably resistant: a person with severe amnesia can still learn a motor skill without remembering having learned it.

Long-term potentiation

- The persistent strengthening of a synapse following high-frequency stimulation — first demonstrated in the hippocampus.
- Increased presynaptic release of glutamate.
- Increased density of postsynaptic receptors, particularly AMPA receptors.
- The result is that the same input now produces a larger response — the cellular basis of a lasting memory.
- The same mechanism operating in the dorsal horn produces central sensitisation, which is pain being learned.

MASSAGE APPLICATION

Designing Home Care That Clients Retain

Every element of good home-care instruction is a direct application of working memory limits and procedural memory strengths.

Rules that follow from the science

- Give two items. Three at the absolute maximum. More items reduce compliance with all of them.
- Teach before the client is deeply relaxed — mid-session or at the start, not in the last two minutes.
- Demonstrate, then have the client perform it while you watch. Procedural memory encodes performance, not description.
- Write it down and hand it over. External storage removes the working memory burden entirely.
- Chunk the instruction: one cue per movement, not a paragraph.

Reinforcement

- Review at the next visit: ask them to show you, not to tell you.
- Use the same words every time; changed wording is processed as new information.
- Attach the exercise to an existing daily routine — a habit already stored is a retrieval cue.
- Record what you gave and what they reported doing. This is required documentation and it is also your outcome measure.

MEMORY DISORDERS

Amnesia: Anterograde and Retrograde

Anterograde amnesia

- Inability to form new memories after the onset of the injury or disease.
- Old memories from before the event remain intact.
- Associated with bilateral hippocampal damage, thromboembolic events, Korsakoff syndrome and severe head injury.
- The person may hold a normal conversation and retain nothing of it minutes later.
- Procedural learning frequently survives — they can improve at a task they do not remember performing.

Retrograde amnesia

- Inability to recall events that occurred before the injury or disease.
- New learning after the event is preserved.
- Typically graded: recent memories are lost more completely than remote ones.
- Common after concussion and traumatic brain injury; the extent often shrinks during recovery.
- The two forms frequently coexist after significant head trauma.

MEMORY DISORDERS

Post-Traumatic Amnesia and Head Injury Red Flags

Post-traumatic amnesia

- The interval after a head injury during which the person cannot lay down continuous new memory.
- Its duration is one of the better predictors of injury severity and of outcome.
- A client who cannot recall the events immediately after an accident has sustained a significant injury, whatever they were told at the time.

Refer, do not treat

- Any new memory loss following head trauma.
- Worsening headache, repeated vomiting, increasing drowsiness or confusion after a head injury — signs of rising intracranial pressure.
- Unequal pupils, new weakness, seizure or slurred speech.
- Any progressive memory decline with no injury, in any age group.
- Document what the client reported, what you observed and the referral you made.

MEMORY DISORDERS

Memory Loss Across the Lifespan

Normal ageing

- Slower retrieval and more frequent word-finding pauses, with intact recognition and intact function.
- Processing speed declines; stored knowledge does not.
- The person remains oriented, independent and aware of the lapses.

When it is not normal

- Mild cognitive impairment — measurable decline greater than expected for age, but daily function preserved.
- Dementia — decline sufficient to impair independent daily living; Alzheimer's disease is the most common cause and is covered in Lecture 6.
- Warning features: getting lost in familiar places, difficulty with familiar tasks, personality change, poor judgment, and the person not recognising the problem.

- Reversible causes exist — thyroid disease, B12 deficiency, depression, medication effects — which is exactly why referral rather than assumption is required.

Werner, R. (2019). A Massage Therapist's Guide to Pathology (7th ed.). Books of Discovery.

CONSENT

Consent and Capacity When Memory Is Impaired

The Health Care Consent Act, 1996 and the CMTO Standard of Practice on Client-centred Care both apply in full when a client's memory or capacity is affected.

Capacity

- Capacity is decision-specific and time-specific — a person may be capable of consenting to a back massage and incapable of consenting to a complex procedure.
- Capacity means being able to understand the information and appreciate the reasonably foreseeable consequences.
- A diagnosis of dementia does not by itself remove capacity.
- Where the client is incapable, consent is obtained from the substitute decision-maker under the hierarchy set out in the Act.

Practical requirements

- Obtain consent before each assessment and treatment, and again before modifying the plan.
- For a client with impaired memory, re-establish consent at each visit and at each transition within the session.
- Use short sentences, one idea at a time, and confirm understanding by asking the client to tell you what will happen.
- Involve a family member or care partner where the client wishes it, and document who was present.
- Written consent is required before assessing or treating sensitive areas.

Health Care Consent Act, 1996 — https://www.ontario.ca/laws/statute/96h02 · CMTO Standard of Practice: Consent — https://www.cmto.com/rules/consent/

TREATMENT PLANNING

Bringing Lecture 2 Into the Plan

What you screen for

- Sleep quantity, sleep quality and the pattern of waking.
- Snoring, witnessed apneas and daytime sleepiness.
- Shift work and schedule irregularity.
- Fatigue that worsens after activity, delayed by a day or more.
- Memory change, particularly after head injury.

What you change in the plan

- Environment: temperature, light, sound and predictability, as deliberate clinical variables.
- Technique: slow, rhythmic and continuous for arousal reduction.
- Dosage: shorter and lighter where post-exertional malaise is present.
- Timing: appointment placement relative to the client's sleep window and work pattern.
- Education: two written home-care items, demonstrated and reviewed.
- Consent: re-established each visit where memory is impaired.

MEMORY

Sensory Memory and the Role of Attention

Sensory memory

- Holds the raw sensory trace of ongoing experience for a fraction of a second to about two seconds.

- Iconic memory is visual and decays in well under a second; echoic memory is auditory and lasts a few seconds.
- Capacity is very large but retention is automatic and involuntary — no rehearsal is possible.
- Its function is continuity: it lets us perceive movement, speech and touch as continuous rather than as fragments.

Attention is the gate

- Only what attention selects passes from sensory memory into working memory. Everything else is lost without ever being available for recall.
- This is why a client can be told something clearly and have no memory of it — the information never entered working memory.
- Pain, anxiety, drowsiness and distraction all narrow the attentional gate.
- Practical rule: secure attention first — say the person's name, pause, make sure they are listening — then give the information.

MEMORY

The Hippocampus and Consolidation

- The hippocampus, within the medial temporal lobe, binds the elements of an experience into a single retrievable episode.
- It is required for the formation of new declarative memories but is not the permanent storage site.
- Systems consolidation gradually transfers the memory to distributed neocortical networks over weeks to years, after which the hippocampus is no longer required for retrieval.
- This explains the graded pattern of retrograde amnesia: the most recent memories, still hippocampus-dependent, are the most vulnerable.
- Bilateral hippocampal damage produces dense anterograde amnesia with relatively preserved remote memory and preserved procedural learning.
- The hippocampus is among the first regions affected in Alzheimer's disease — which is why short-term memory fails first while old memories persist.

SLEEP AND MEMORY

Why Sleep Consolidates What You Taught

The mechanism

- During slow-wave NREM sleep the hippocampus replays the day's encoded sequences to the neocortex, driving systems consolidation.
- REM sleep is associated with the consolidation of procedural and emotional memory.
- A night of sleep after learning produces measurably better retention and better motor performance than an equivalent period awake.
- Sleep deprivation impairs both the encoding that happens before sleep and the consolidation that would have happened during it.

What this changes in practice

- A client with disrupted sleep will retain home-care instruction poorly no matter how well it is delivered.
- Written instruction becomes more important, not less, in the poorly sleeping client.
- Motor skill acquisition — a new postural pattern, a new exercise — genuinely improves overnight; expect the second attempt at the next visit to be better than the last attempt at this one.
- Reviewing at the following visit is not repetition for its own sake; it is a second consolidation opportunity.

CLINICAL APPLICATION

Sleep, Pain and the Bidirectional Loop

Sleep and pain influence each other in both directions, and the relationship is now considered stronger from sleep to pain than from pain to sleep.

How the loop runs

- Pain fragments sleep, reducing deep NREM and total sleep time.
- Reduced sleep lowers pain threshold and impairs descending inhibition, so the next day's pain is worse for the same tissue state.
- Worse pain further fragments the following night's sleep.
- Anxiety about both amplifies arousal at each turn of the loop.

Where massage therapy enters

- The therapy can interrupt the loop at two points: reducing the nociceptive input that fragments sleep, and reducing the arousal that prevents sleep onset.
- This is a legitimate, explainable rationale to include in the treatment plan and in the client's own understanding.
- It also sets a realistic expectation: improvement will appear over several sessions as the loop unwinds, not immediately.
- Track reported sleep alongside reported pain — the two should move together, and if they do not, revisit the plan.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Stress Reduction.

CLINICAL APPLICATION

Sleep Position, Support and Musculoskeletal Pain

Advising on sleeping position and support is within scope: it addresses positioning of the soft tissues and joints and it prevents physical dysfunction.

Common patterns

- Prone sleeping requires sustained cervical rotation for six to eight hours and is a frequent contributor to unilateral neck pain.
- Side lying with an inadequate pillow drops the head into lateral flexion and loads the contralateral scalenes and upper trapezius.
- Side lying without a pillow between the knees allows hip adduction and internal rotation, loading the lateral hip and lumbar spine.
- Supine with a very high pillow sustains cervical flexion and can aggravate suboccipital pain and headache.
- Sleeping with an arm overhead sustains shoulder abduction and can provoke thoracic outlet symptoms.

What to advise

- Match pillow height to the distance between the neck and the mattress in the client's habitual position.
- A pillow between the knees in side lying and under the knees in supine.
- Change one thing at a time; a wholesale change of sleeping habit is rarely sustained.
- Stay within scope: advise on positioning and support, not on mattresses as medical devices or on sleep medication.
- Document the advice given and review its effect at the next visit.

Massage Therapy Act, 1991, S.O. 1991, c. 27, s. 3 (Scope of Practice) — https://www.ontario.ca/laws/statute/91m27

CASE APPLICATION

The Shift-Working Client

A 41-year-old warehouse supervisor on rotating twelve-hour shifts presents with generalised neck and shoulder aching, headaches on waking, and the report that nothing seems to help for long.

What the history should establish

- Shift pattern, rotation direction and how many consecutive nights.
- Total sleep on work days versus days off, and whether sleep is in one block or divided.

- Caffeine timing, and use of alcohol as a sleep aid.
- Whether the headaches are present on days off — a strong clue to the contribution of schedule.
- Snoring or witnessed apneas, which would change the referral question entirely.

What the plan should contain

- Recognise that circadian disruption is amplifying the musculoskeletal complaint; treat the tissue, but set expectations accordingly.
- Schedule appointments at a consistent point in the shift cycle rather than at a convenient clock time.
- Relaxation-focused work with the specific goal of reducing arousal, plus targeted work on the cervical and shoulder girdle findings.
- Two home-care items only, written, tied to an existing routine.
- Refer for medical assessment if snoring, witnessed pauses or severe daytime sleepiness are present.
- Document the sleep pattern as an outcome measure alongside pain.

CASE APPLICATION

The Client With Post-Concussion Memory Change

A 27-year-old cyclist, six weeks after a fall with brief loss of consciousness, presents with neck pain and headache and mentions in passing that their memory has not been right since.

What must happen first

- Establish whether the injury was medically assessed and what was found.
- Screen for red flags: worsening headache, vomiting, increasing drowsiness, visual change, new weakness, seizure.
- Establish whether the memory change is stable, improving or worsening. Worsening is referred urgently.
- Do not treat, and refer immediately, if any red flag is present.

If it is safe to proceed

- Cervicogenic contribution to post-concussion headache is real, common and treatable within scope.
- Keep sessions short and conservative; symptom-guided, with the client's current tolerance setting the pace.
- Avoid positions and techniques that provoke dizziness; move the client slowly between positions.
- Give home care in writing and check it verbally at the next visit — memory impairment makes verbal-only instruction unreliable.
- Re-refer if new or worsening neurological or cognitive symptoms appear at any point.

Rattray, F., & Ludwig, L. (2000). Clinical Massage Therapy: Understanding, Assessing and Treating Over 70 Conditions. Talus Inc. ISBN 978-0-9698177-1-0 — condition entry: Headaches.

DOCUMENTATION

Recording Sleep and Cognitive Findings

What to record

- Reported sleep duration, sleep onset, number of wakings and how refreshed the client feels — in the client's own terms.
- Objective observations: level of consciousness, orientation, difficulty rousing after treatment.
- Any screening question asked and the answer, including negative answers.
- Any red flag identified, the advice given and the referral made, with the date.
- Home care given, and what the client reported doing.

Why it matters

- Record keeping is a Standard of Practice requirement, not an administrative preference.
- Sleep is a measurable outcome; without a baseline you cannot demonstrate change.
- Objective documentation of a cognitive finding is what makes a referral letter useful to a physician.

- Records are retained for ten years after the last visit, or ten years after the client turns eighteen.
- Write what you observed and what the client said, not what you concluded about a diagnosis.

CMTO Standard of Practice: Record Keeping — https://www.cmto.com/rules/record-keeping/

SUMMARY

Key Takeaways

- Wakefulness is produced by the reticular activating system, with timing set by the hypothalamic suprachiasmatic nucleus and the pineal gland on a roughly 24-hour cycle.
- Sleep alternates between NREM, which is restorative and permits movement, and REM, which produces dreaming under muscle atonia; the parasympathetic division dominates throughout.
- Relaxation-focused massage produces the same autonomic signature as sleep onset, and the treatment environment is half of that effect.
- Sleep deprivation lowers pain threshold, impairs healing and amplifies musculoskeletal complaint — screen for it before attributing everything to tissue.
- Insomnia and sleep apnea are screened and referred; massage supports sleep by reducing pain and arousal, and does not treat the disorder.
- Chronic fatigue syndrome is governed by post-exertional malaise: treat well below tolerance and judge the dose by the response two days later.
- Neuroplasticity requires repetition, attention, relevance and feedback — which is why home care, not the passive session, produces durable change.
- Working memory holds a handful of items for seconds; give two written home-care items, demonstrated, and review them next visit.

CONSOLIDATION

Review Questions and References

Review questions

- Which structures set the circadian rhythm, and what hormone does the pineal gland secrete?
- State three differences between NREM and REM sleep, and explain the purpose of REM atonia.
- Why does the physiology of massage-induced relaxation resemble the physiology of sleep onset?
- What is post-exertional malaise, and how does it change the way you dose a treatment?
- Define long-term potentiation and explain its relationship to central sensitisation.
- Give four rules for home-care instruction that follow from the limits of working memory.
- Distinguish anterograde from retrograde amnesia, and list four head-injury red flags.

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