Motion Sickness Susceptibility (MSS) — Cheat Sheet for Vestibular Physicians

A measurable, heritable trait — quantify and document it at first assessment. A core clinical variable that predicts vestibular migraine, amplifies PPPD, and shapes treatment response — not an incidental finding.

► Why MSS matters

MSS is a quantifiable psychophysical trait — the propensity to generate nausea, emesis and autonomic upset to real or apparent motion. It is not a disease but a normally distributed, heritable biological parameter modified by exposure. Clinically relevant MSS affects ~33–40% of adults; women score 25–40% higher in reproductive years. It is premorbid in vestibular migraine, amplifies PPPD, predicts poor tolerance of provocative testing, and governs treatment response — so quantify and record it for every new vestibular patient.

► When to measure MSS

- ► Any patient where vestibular migraine, PPPD, or visually-induced/screen-triggered dizziness is in the differential.
- ► Childhood-onset motion sickness, strong migraine family history, or nausea out of proportion to provocation.
- ► New or worsening MSS in middle age or over 65 — treat as a red flag (see below).

► Assessment instruments

Instrument	What it captures	Threshold / interpretation
MSSQ-Short (Golding 1998)	Historical susceptibility across 9 transport/environmental modes; subscale A (childhood), B (last 10 yrs); score 0–18	High over 9, very high over 12. Median 6.4 women / 4.8 men
VIMSSQ-Short (Golding & Keshavarz 2023)	Visually-induced triggers — cinema, gaming, VR, scrolling, simulators	High over 10; over 12 flags occupational VIMS risk; strongly associated with PPPD
Single-item screen	“Can you read in a moving car without becoming sick?”	~74% sensitivity / 69% specificity for high MSS; positive triples odds of vestibular migraine
Rotatory chair (velocity storage)	Time constant (TV) — most objective physiological correlate	TV over 15–20 s marks high susceptibility

***Pearl —** The A/B ratio steers the differential — a childhood-dominant pattern (high A) is typical of migraine-associated MSS; an adult-onset rise (high B, low A) should prompt a search for new vestibular or cerebellar pathology.*

► Pathophysiology in brief

► Sensory conflict — sickness is a prediction error between expected and actual vestibular/visual/proprioceptive input; severity scales with degree and duration of mismatch.

► Velocity storage — a brainstem integrator with time constant TV; long TV sustains the mismatch signal. The nodulus and uvula gate it, so new middle-age MSS warrants cerebellar imaging.

► Emetic cascade — vestibular nuclei to NTS and area postrema (chemoreceptor trigger zone) to the dorsal vagal nucleus; the target of antimuscarinic and H1 drugs. Shared trigeminal-vestibular and serotonergic circuitry explains the migraine overlap.

► MSS across vestibular disorders

Diagnosis	MSS timing & profile	Management priority
Vestibular migraine	PREMORBID trait; MSSQ 40–60% above controls; childhood MSS in over 70%	Anti-migraine prophylaxis first; MSSQ tracks response
PPPD / VIMS	Visual-dependence phenotype; VIMSSQ loads with PPPD severity	Graded optokinetic desensitisation; SSRI/SNRI
Ménière's disease	SECONDARY — coincides with disease onset; no childhood history	Treat hydrops; VRT; monitor MSSQ
Post-concussive	Elevated VIMSSQ; prognostic at 4–8 weeks	Early graded habituation, NOT prolonged visual rest
Mal de débarquement	Shares velocity-storage neurobiology; oscillatory perception	Optokinetic re-adaptation ONLY; anticholinergics/antihistamines do not help and may worsen

***Pearl —** Premorbid versus disease-coincident timing is the key differentiator: current motion sickness WITHOUT a childhood history favours Ménière's over vestibular migraine.*

► Non-pharmacological management (first-line, counsel at first visit)

- ► Behavioural / environmental — lowest-motion seat, stable-horizon fixation, recline head, disclose the journey in advance.
- ► Diaphragmatic breathing at 6 breaths/min — taught and rehearsed before travel (RCT-supported).
- ► Graded habituation — the only approach that updates the internal model; start sub-threshold (slow optokinetic, 5-min rides), advance over 4–8 weeks; do not precede a session with uncontrolled provocation.
- ► VRT for VIMS — gaze stabilisation, graded optokinetic stimulation, sensory reweighting; target a 3-point MSSQ-Short reduction. CBT / HRV biofeedback for high anxiety burden.

► Pharmacological agents

Agent	Dose	Role / evidence	Caveats
Scopolamine (transdermal)	1.5 mg patch	Best-supported prophylactic (Cochrane)	Apply ~4 h pre-exposure; lasts 72 h. Anticholinergic; avoid in elderly (Beers)
Cinnarizine	25 mg TDS	First-line H1; favourable tolerability	Preferred in elderly; limited pregnancy data
Dimenhydrinate	50 mg q4–6h	First-line H1 workhorse	Sedation; compatible in pregnancy
Promethazine	25 mg	Highest anti-emetic efficacy of class	Most sedating; contraindicated with operator duties; avoid 1st trimester
D2 antagonist (prochlorperazine / domperidone)	5–10 mg / 10 mg	Adjunct for migraine nausea-dominant MSS	Reserve for refractory; optimise prophylaxis first
Ginger	1–2 g pre-exposure	Modest evidence; pregnancy-safe option	First-line where antihistamines avoided
Ondansetron (5-HT3)	—	Weak for motion sickness	Effective for chemo/post-op nausea, NOT first-line for MSS

***Pearl —** Two rules: scopolamine works only if applied ~4 h before exposure (not reactively); and avoid maintenance vestibular suppressants — they impede central adaptation. Non-sedating second-generation antihistamines (cetirizine, fexofenadine) do not work for motion sickness.*

► Special populations & red flags

- ► Pregnancy — first trimester amplifies MSS; dimenhydrinate, cyclizine and ginger are safer; avoid scopolamine and promethazine.
- ► Elderly — paradoxically less susceptible; Beers flags scopolamine and diphenhydramine; prefer cinnarizine/cyclizine and review all new drugs.
- ► Occupational — graded habituation reduces aircrew/seafarer attrition; sedating agents are barred for operator duties.
- ► Red flag — complete bilateral vestibular loss confers immunity to classical MSS; NEW adult-onset or worsening MSS in middle age or over 65 should prompt cerebellar imaging and a medication review.

Key references — Reason & Brand 1975 (sensory conflict) · Golding. Brain Res Bull 1998 (MSSQ-Short) · Golding & Keshavarz 2023 (VIMSSQ-Short) · Reavley et al. 2006 (heritability) · Hromatka et al. 2015 (GWAS) · Spinks et al. Cochrane 2004 (scopolamine) · Karrim et al. Cochrane 2022 (antihistamines) · Abouzari et al. 2021 (VM).