

Light + NeuronaQL Music for Acute Stress Regulation:

A Physician-Supervised Pilot Case Series

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ABSTRACT

Background: Stress produces autonomic arousal, elevated blood pressure, and muscle tension, and brief, low-burden regulation tools are attractive in clinical and wellness settings. Combined audiovisual input has been reported to produce greater relaxation than sound or light alone, but physician-supervised protocols pairing composed music with light stimulation and objective tracking are rarely described.

Objective: To describe the feasibility, tolerability, and acute within-subject responses of a single physician-supervised session of NeuronaQL music paired with light stimulation in adults with self-reported stress.

Methods: Single-site, physician-supervised pilot case series with a within-subjects (pre/post) design in which each participant served as their own control. Ten adults with self-reported stress completed one 10 minute session of NeuronaQL music (five structured modules) with light stimulation; one participant completed a music-only (no-light) variation. Self-reported stress, calm, and body tension (0–10), blood pressure, pulse, a post-session experience checklist, and device-derived EEG band proportions and calm/relaxed/active state-flow were recorded. Analysis was descriptive.

Results: Self-reported stress fell (mean 3.7 → 1.7; ~54% lower), calm rose (4.7 → 8.9; ~89% higher), and body tension fell (5.7 → 2.2; ~61% lower). Diastolic blood pressure and pulse showed favorable mean trends. Device data showed a high proportion of session time in a calm state with a beta-dominant band profile. All ten sessions were completed with no adverse events.

Conclusion: Acute stress and tension decreased and calm increased in the direction proposed for combined light + NeuronaQL music, with the effect persisting in the single music-only case. Findings are hypothesis-generating and support a future controlled, blinded study.

LEARNING OBJECTIVES

1. Describe a single-visit, physician-supervised protocol pairing structured music with light stimulation for acute stress regulation.
2. Recognize the within-subjects (pre/post) pattern of change in self-reported stress, calm, and body tension.
3. Interpret device-derived EEG band proportions and calm-state classification as exploratory, hypothesis-generating signals rather than diagnostic findings.
4. Identify why an uncontrolled pilot justifies — but cannot replace — a future controlled study.

BACKGROUND

Stress is a common patient-reported concern associated with subjective distress, autonomic arousal, elevated blood pressure, and skeletal muscle tension. Because sustained stress contributes to cardiovascular strain and impairs clear thinking, brief, repeatable, low-burden tools that acutely shift stress-related measures are attractive in both clinical and wellness settings.

Two lines of prior work motivate this study. First, combined audiovisual input has been reported to produce greater relaxation than either sound or light alone, suggesting that multisensory delivery may be more effective than a single modality. Second, music paired with rhythmic or patterned light has been associated with reduced autonomic arousal and blood pressure. Together these support the central premise of this work: that the right structured sensory input can shape a measurable calming output.

Despite this, physician-guided protocols that combine purpose-composed music with light stimulation and pair them with objective physiologic and device-derived tracking are rarely described. This pilot case series was designed to address that gap in a practical, safety-screened, single-visit format, while explicitly avoiding diagnostic or treatment claims.

MATERIALS & METHODS

Design. Single-site, physician-supervised pilot case series using a within-subjects (pre/post) design, in which each participant served as their own control by comparing their own pre-session and post-session values.

Participants. Ten adults (N = 10) presenting with self-reported stress. Each underwent safety screening, and all sessions were conducted under the direct supervision of a neurosurgeon (Dr. Saied Jamshidi, MD, FACS). Screening addressed seizure history, photosensitivity, migraine/light sensitivity, cardiovascular concerns, and other physician-identified contraindications to light stimulation.

Intervention. A single session of NeuronaQL music — a standardized five-module sequence targeting orientation, emotional unloading, somatic release, cognitive recognition, and coping integration — delivered together with light stimulation. Session duration ranged from approximately 8 to 20 minutes. One participant completed a music-only (no-light) variation because they had not taken their prescribed seizure medication that day; in the interest of safety, the supervising physician elected to proceed without light stimulation for that session.

Measures.

- Self-reported stress, calm/relaxation, and body tension on 0–10 numeric rating scales, immediately before and after the session.
- Blood pressure (systolic/diastolic) and pulse, before and after.
- A post-session experience checklist (less stressed, more calm/grounded, less body tension, emotionally lighter, more focused/clear, sleepier/more energized/more emotional, and any discomfort/dizziness/eye discomfort/overstimulation), rated Not at all / Mild / Moderate / Strong.
- Device-derived EEG band proportions (delta, theta, alpha, beta, gamma) and calm/relaxed/active state-flow with a device performance score.

Analysis. Descriptive within-subject analysis. For each case, pre/post change scores were calculated and summarized across the series using means, direction of change, and individual response patterns. Given the design, no inferential efficacy testing was performed.

Ethics and framing. The study was framed as a wellness and feasibility pilot and does not make diagnostic or treatment claims. Participation was voluntary and participants could stop at any time.

RESULTS

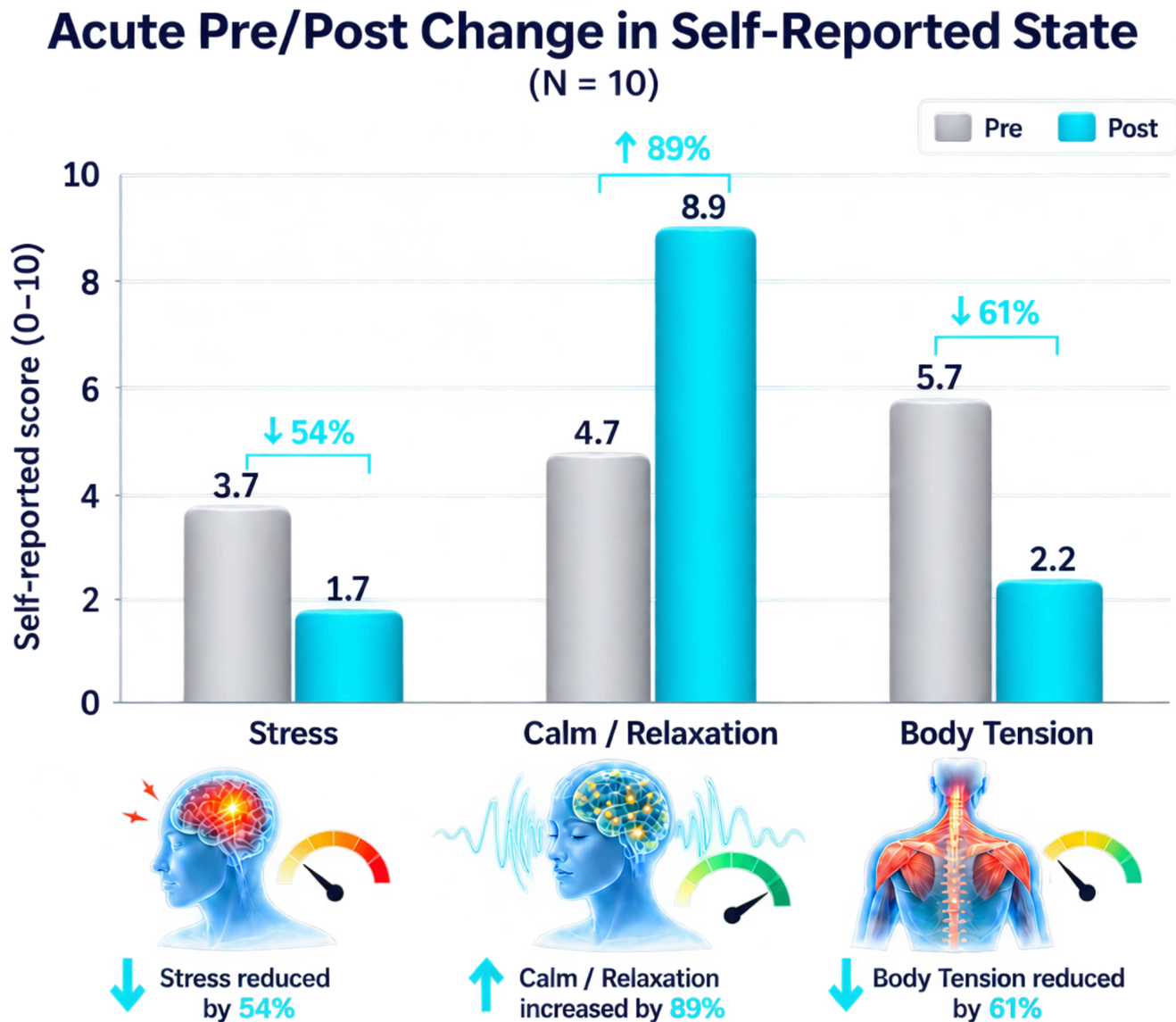


Figure 1. Acute pre/post change in self-reported state (N = 10).

Group mean self-reported scores (0-10) before and after a single Light + Neurona QL Music session. Stress fell 54% (3.7→1.7), calm/relaxation rose 89% (4.7→8.9), and body tension fell 61% (5.7→2.2). Descriptive data from an uncontrolled, unblinded exploratory case series.

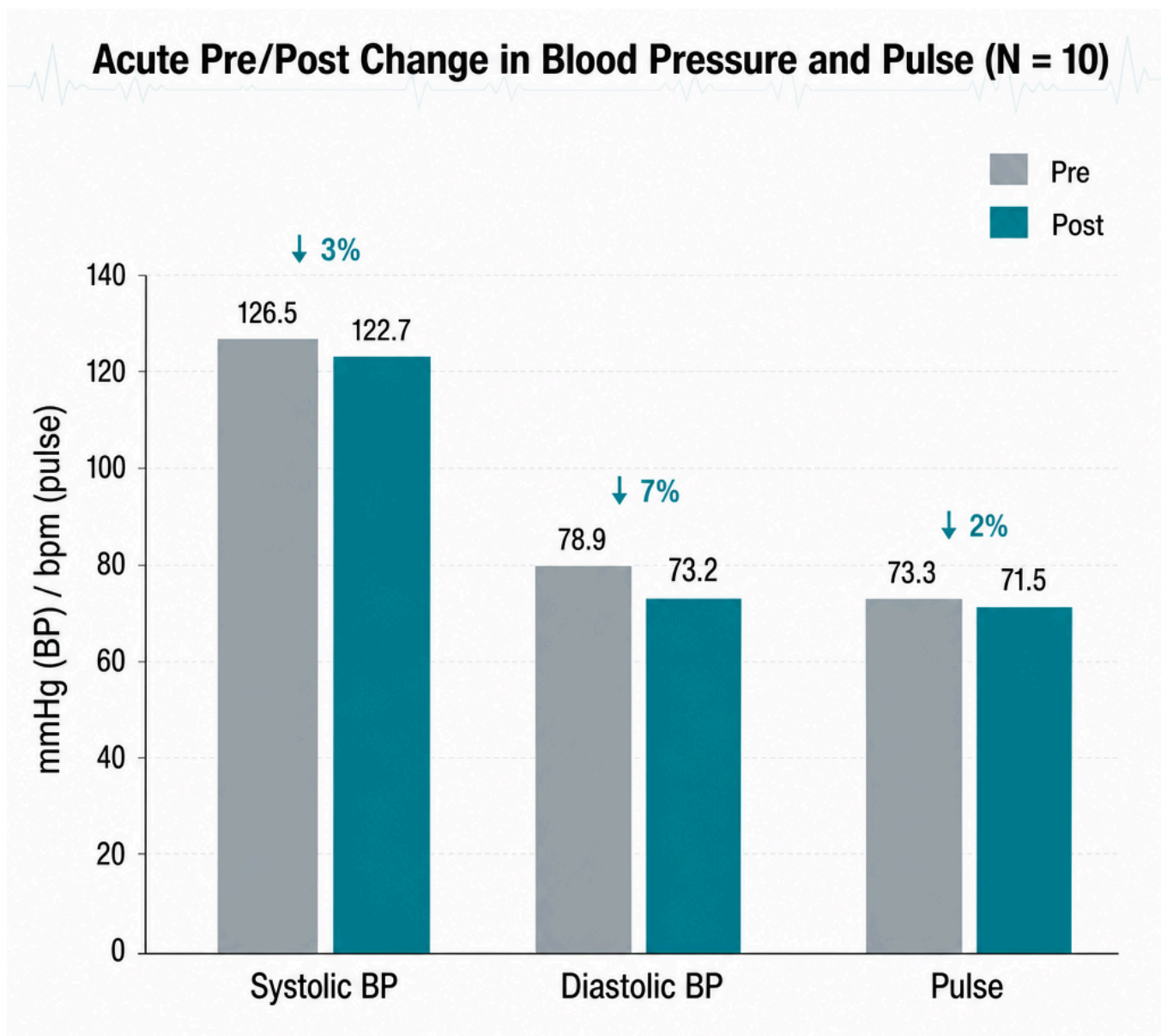


Figure 2. Acute pre/post change in blood pressure and pulse (N = 10).

Group mean systolic BP, diastolic BP, and pulse before and after a single session. All three showed small mean reductions (systolic -3%, diastolic -7%, pulse -2%). Values are descriptive; no control condition or blinding, and individual responses varied (including transient increases in some participants).

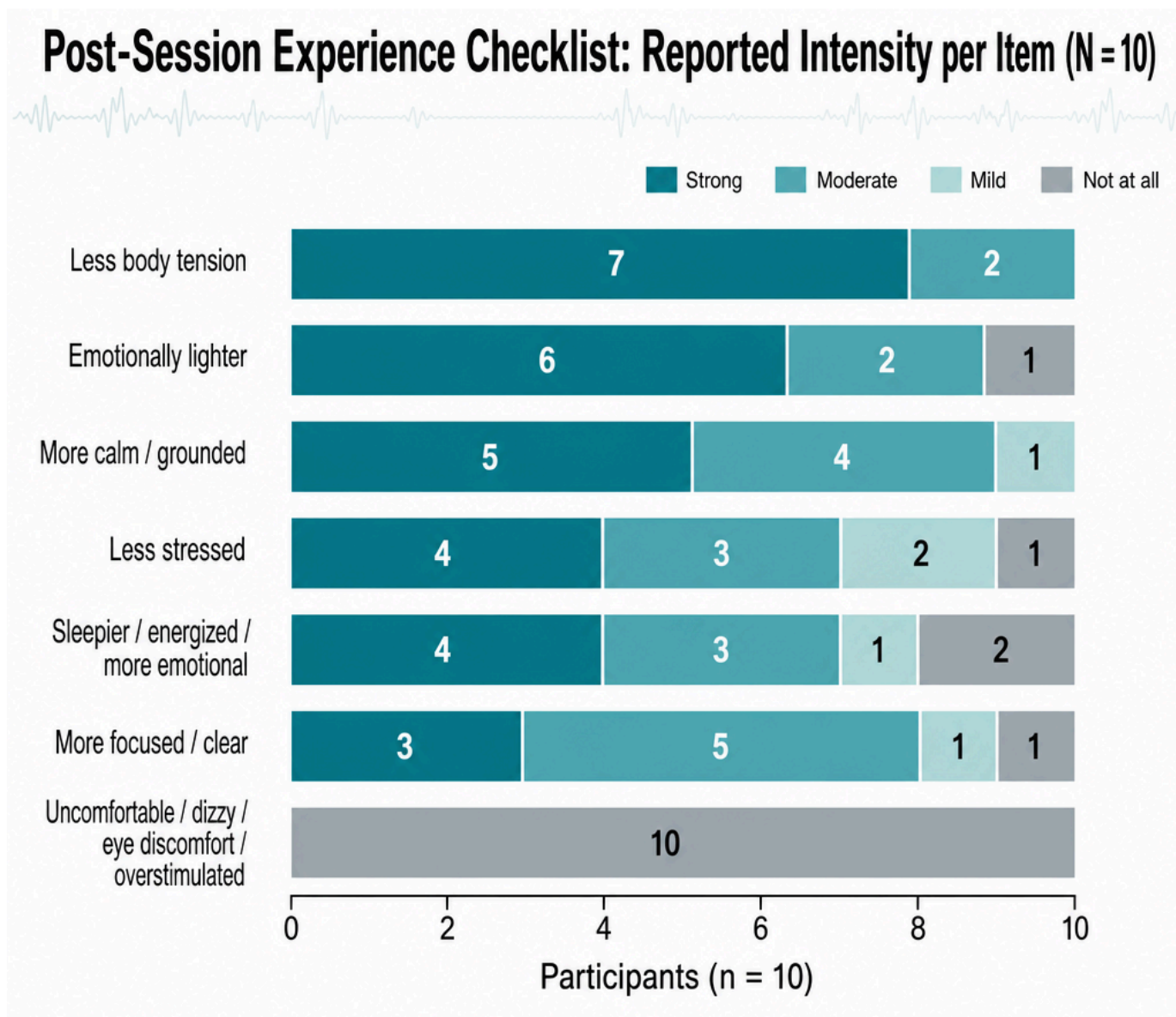


Figure 3. Post-session experience checklist: reported intensity per item (N = 10).

Distribution of Strong/Moderate/Mild/Not-at-all ratings across checklist items after a single session (two items scored out of 9 due to unmarked responses). Reduced body tension, emotional lightening, and greater calm were most consistent; no participant reported discomfort, dizziness, visual discomfort, or overstimulation (0/10).

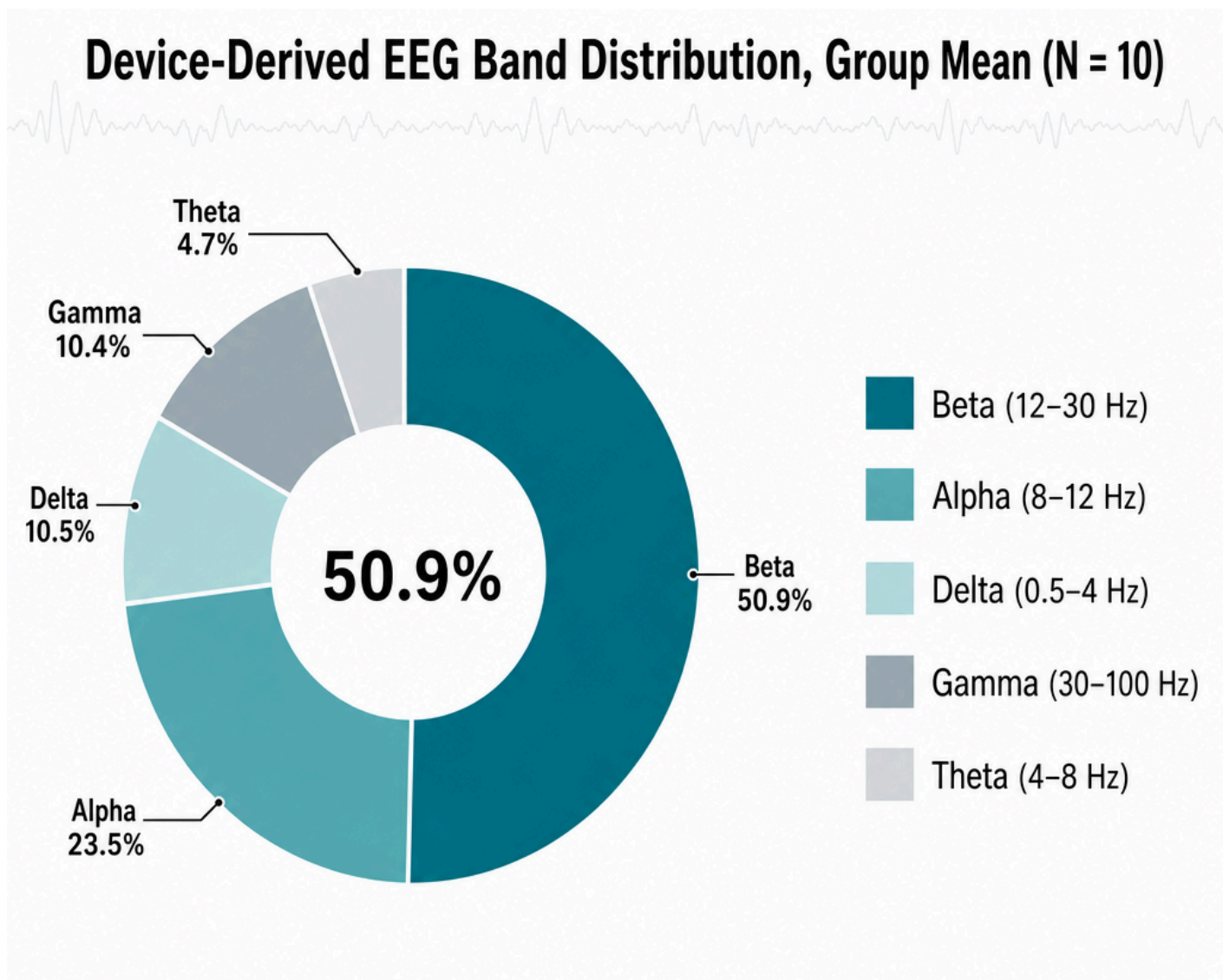


Figure 4. Device-derived EEG band distribution, group mean (N = 10).

Group mean proportion of session time in each EEG frequency band from the wearable device during a single session (Beta 50.9%, Alpha 23.5%, Delta 10.5%, Gamma 10.4%, Theta 4.7%). Single-channel, device-computed values subject to motion/high-frequency artifact; exploratory signal only, not validated spectral analysis.

Device-Derived State Flow per Session (N = 10)

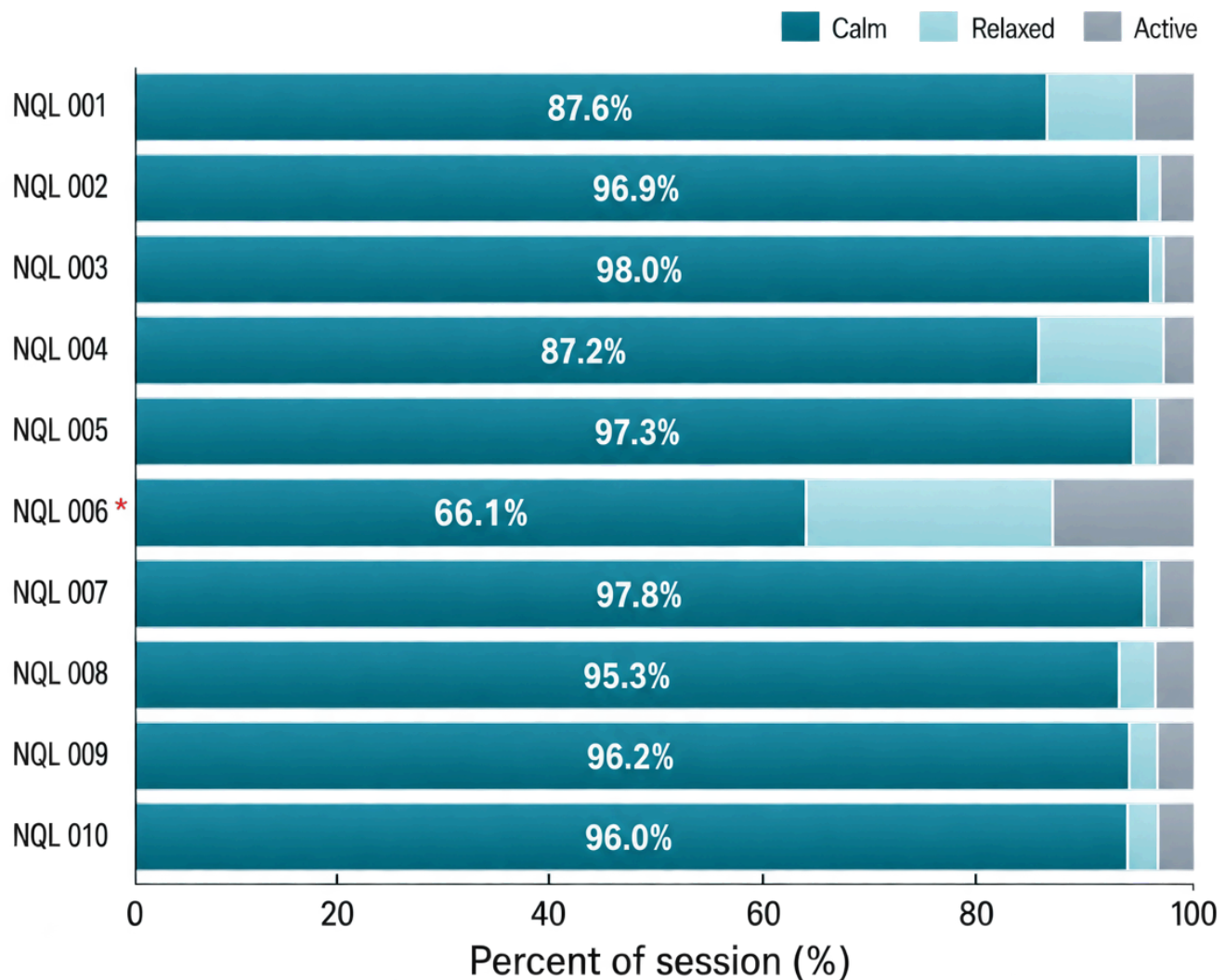
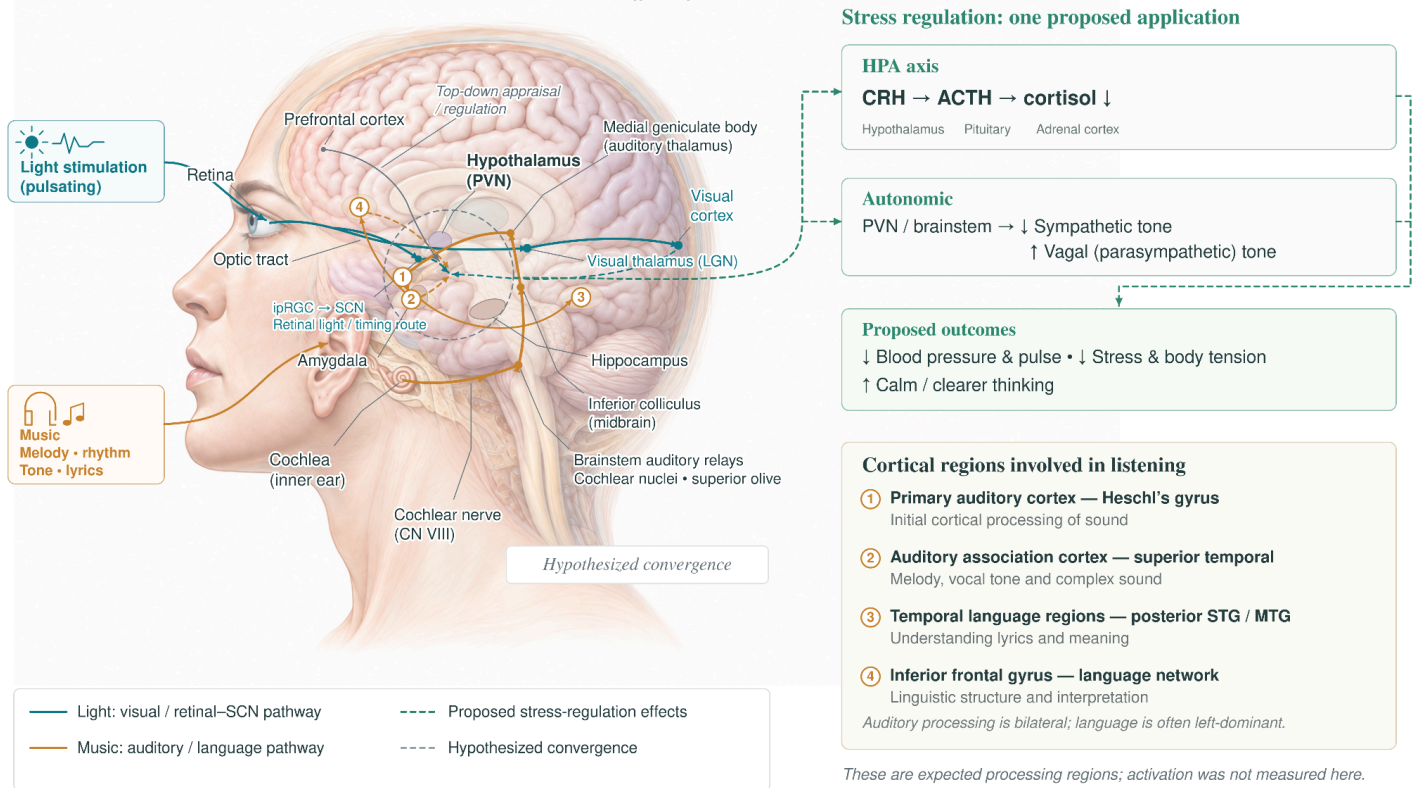


Figure 5. Device-derived state flow per session (N = 10).

Device-classified proportion of each session spent in Calm, Relaxed, and Active states. Nine of ten sessions were predominantly (>87%) calm; the single no-light protocol variation (NQL 006, asterisk) showed the lowest calm proportion (66%). Proprietary device-computed classification, presented as exploratory signal.

Light and Music Across Brain Networks A Hypothesis of Input-Dependent Modulation

Selected light patterns, rhythms, tones and lyrics may coordinate activity across brain networks toward different functional outcomes.



Conceptual illustration. Routes and deep structures are simplified projections; convergence and downstream changes were not established in this study.

Figure 6. Light and music across brain networks: a proposed model of input-dependent modulation of limbic and autonomic circuits.

Conceptual model of how visual/thalamic light input and auditory/language input from Light + NeuronaQL music (with lyrics) are hypothesized to converge on shared limbic and autonomic circuits to influence stress-related outputs. Light input travels retina → optic tract → visual thalamus (lateral geniculate nucleus) → visual cortex, with a proposed intrinsically photosensitive retinal ganglion cell (ipRGC) branch to the suprachiasmatic nucleus and hypothalamus. Music input travels cochlea → cochlear nerve (CN VIII) → brainstem auditory relays (cochlear nuclei, superior olive) → inferior colliculus → medial geniculate body (auditory thalamus) → auditory cortex, with a temporal/inferior-frontal language branch for lyric processing. Both streams are hypothesized to converge on the amygdala, hippocampus, and

hypothalamus (paraventricular nucleus, PVN), with prefrontal top-down appraisal reducing amygdala drive. Proposed convergence onto the PVN and brainstem autonomic centers is hypothesized to lower sympathetic tone and increase vagal tone, and to reduce HPA-axis drive (CRH → ACTH → cortisol), yielding the proposed outcomes of reduced blood pressure and pulse, reduced subjective stress and body tension, and increased calm/clearer thinking.

Numbered cortical listening regions denote expected processing nodes: (1) primary auditory cortex (Heschl's gyrus), (2) auditory association cortex (superior temporal), (3) temporal language regions (posterior STG/MTG), and (4) inferior frontal gyrus language network; auditory processing is bilateral and language is often left-dominant.

Individual sensory and regulatory pathways are supported by prior work — including retinohypothalamic ipRGC–suprachiasmatic signaling, brainstem–limbic autonomic connectivity, and prefrontal top-down regulation of limbic activity (Cauzzo et al., *NeuroImage*, 2022; Osada et al., *Nature Communications*, 2024). Their convergence in this combined intervention is hypothesized and was not demonstrated by this uncontrolled, unblinded case series; cortical/subcortical activation was not measured. Routes and deep structures are simplified projections. Solid lines denote sensory pathways (teal: light/retinal–SCN; amber: music/auditory–language); dashed lines denote hypothesized convergence and proposed stress-regulation effects. The diagram is conceptual and illustrative only.

Results summarized:

Self-report (0–10)

- Stress: 3.7 → 1.7 (~54% lower); improved in 7/10, unchanged in 3/10.
- Calm/relaxation: 4.7 → 8.9 (~89% higher); improved in 9/10.
- Body tension: 5.7 → 2.2 (~61% lower); improved in 8/10.

Cardiovascular

- Systolic blood pressure: 126.5 → 122.7 mmHg.
- Diastolic blood pressure: 78.9 → 73.2 mmHg.
- Pulse: 73.3 → 71.5 bpm.

Device-derived

- Calm-state: approximately 92% of session time in a calm state; mean performance score ~88/100.
- EEG band proportions (mean): beta ~51%, alpha ~23%, delta ~10%, gamma ~10%, theta ~5%.

Safety and feasibility

- 10/10 sessions completed; no adverse events; no early stops.

DISCUSSION

Across this small within-subjects series, the direction of change was consistent: self-reported stress and body tension decreased while calm increased, accompanied by favorable mean diastolic and pulse trends. Because each participant served as their own control, these pre/post shifts describe individual response patterns rather than between-group effects.

The device data warrant careful interpretation. A high proportion of session time was classified as calm even though band proportions were beta-dominant. This is best read as relaxed, wakeful attention rather than a contradiction: a calm but awake and engaged listener can show substantial beta activity, and consumer-grade EEG band proportions are sensitive to movement and high-frequency artifact (particularly in the gamma range). The calm-state classification and

the raw band proportions therefore capture different things and should both be treated as exploratory.

The cardiovascular findings are modest but internally consistent with the self-report pattern. Mean diastolic blood pressure and pulse trended downward, and the direction of the systolic and diastolic means aligned with the participants' reported reduction in stress and tension. These averages, however, conceal meaningful individual variation: some participants entered the session with normal baseline pressures and had little room to fall, while others with higher baselines showed larger shifts. Because blood pressure and pulse are influenced by posture, timing, conversation, white-coat effects, and the simple act of sitting quietly for several minutes, these values should be read as supportive context for the subjective findings rather than as independent evidence of an autonomic effect. Their principal value here is that they move in the same direction as the primary outcomes rather than against them.

The post-session experience checklist adds texture that a single stress score cannot. Participants most often endorsed feeling less stressed, more calm or grounded, and less body tension, with a substantial number also reporting feeling emotionally lighter or more focused. A subset reported feeling sleepier or more emotional, and one session produced an emotional release (tearfulness) during the first module — an expected response to a permission-based, emotionally oriented sequence rather than an adverse event. Critically, discomfort, dizziness, eye discomfort, and overstimulation were rarely or never endorsed, which supports tolerability alongside the completion and adverse-event data. This spread of responses is consistent with a genuine acute affective shift rather than a single narrow effect, and it identifies which experience domains are worth tracking formally in a future study.

Figure 6 proposes, as a hypothesis, how two input streams — light (retina → thalamic/visual and suprachiasmatic routes) and music with lyrics (cochlea → auditory cortex, with a language/temporal-cortex branch) — may converge on shared limbic and autonomic hubs (amygdala, hypothalamic paraventricular nucleus, brainstem autonomic centers), with prefrontal and hippocampal circuits providing top-down regulation. The framing is deliberately

mechanistic-but-tentative: convergence is hypothesized and not demonstrated by this uncontrolled series. Notably, the single music-only (no-light) case still showed improvement, which is consistent with the composed music itself carrying meaningful regulatory signal.

The music-only case deserves emphasis because it functions as an unplanned but informative natural experiment. That participant proceeded without light because they had not taken their prescribed seizure medication that day, and the supervising physician elected the safer variation. That improvement still occurred when the light component was removed suggests the structured music is not merely an accompaniment to the light but may be an active ingredient in its own right. This is exactly the kind of observation that a controlled, component-isolating design is needed to confirm, since a single case cannot separate a true music effect from expectancy, settling, or individual factors.

Taken together, these observations are broadly consistent with prior reports that multisensory (audiovisual) input can produce greater relaxation than a single modality and that music paired with light is associated with reduced autonomic arousal. The present series does not test those claims, but its direction of effect and tolerability profile align with them and support the premise that purposefully structured sensory input can shape a measurable calming output. The clinical relevance is that a brief, repeatable, low-burden session — delivered under physician oversight with objective tracking — acutely moved stress, tension, and calm in a favorable direction across a heterogeneous small sample, which is a reasonable precondition for investing in a rigorous trial.

LIMITATIONS

- Uncontrolled and unblinded, with no separate comparison group; the within-subjects design mitigates but does not replace a true control.
- Small sample (N = 10) limits inference and precludes statistical efficacy claims.
- Primary outcomes are self-reported and susceptible to expectancy and demand effects.
- Regression to the mean, natural settling in a quiet environment, and repeated-measurement effects cannot be excluded.
- Light and music were delivered together in most sessions, so component-specific effects are not separable (with the single music-only case as a limited exception).

- Device-derived EEG band data are artifact-sensitive and exploratory.
- The founder of NeuronaQL developed the intervention and participated in the study (see Disclosure).

CONCLUSION

Acute stress decreased in the direction proposed for combined light stimulation and NeuronaQL music: mean self-reported stress fell approximately 54%, body tension approximately 61%, and calm rose approximately 89%, with supportive diastolic blood pressure and pulse trends.

Critically, these were not isolated responders — the direction of change was consistent across the series, with stress improving in most participants, calm improving in nearly all, and body tension improving in the majority. This convergence of self-report, cardiovascular trend, and device-derived calm-state classification toward the same endpoint strengthens the internal coherence of the signal, even within an uncontrolled design.

The effect held across the series and persisted in the single music-only (no-light) case. That participant proceeded without light stimulation because they had not taken their prescribed seizure medication that day, and the supervising physician elected the safer music-only variation. That this case still showed improvement is informative: it suggests the composed NeuronaQL music itself carries a meaningful regulatory signal independent of the light component, while the combined protocol as a whole remained safe and feasible. This observation directly motivates the component-isolation design proposed below.

A single physician-supervised session was well tolerated (10/10 completed, no adverse events, no early stops), supporting the premise that structured sensory input can shape a measurable calming output. Lower acute stress and tension are clinically meaningful because sustained stress drives autonomic arousal, elevated blood pressure, and impaired clear thinking; when the body tenses, cognition narrows. A brief, repeatable, low-burden tool that acutely shifts these measures — delivered in roughly 10 minutes, under physician oversight, with objective tracking — is therefore worth rigorous testing, both as a stand-alone wellness intervention and as a potential adjunct in settings where acute stress interferes with care.

The proposed mechanism remains a hypothesis. Figure 6 frames how an auditory pathway (music and lyrics) and a visual pathway (patterned light) might converge on shared limbic and autonomic hubs — the amygdala, hypothalamic paraventricular nucleus, and brainstem autonomic centers — with prefrontal and hippocampal circuits exerting top-down regulation. This model is consistent with prior work on multisensory relaxation and music-associated autonomic change, but convergence is not demonstrated by this series and should be read as a direction for testing rather than a conclusion.

These findings are hypothesis-generating. They justify a controlled, blinded study that isolates music, light, and combined conditions against a comparison condition, enrolls an adequately powered sample, and uses validated outcome measures alongside artifact-controlled physiologic recording. Such a design would determine whether the acute changes observed here reflect a true intervention effect, disentangle the relative contributions of music and light, and establish whether the acute calming response translates into durable, clinically meaningful benefit.

DISCLOSURE

G. Kraja is the founder of NeuronaQL and developed the music intervention evaluated in this study. This uncontrolled, unblinded pilot case series was conducted for feasibility and tolerability and does not make diagnostic or treatment claims. All sessions were conducted under the supervision of Dr. Saied Jamshidi, MD, FACS (neurosurgery).

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