

Effectiveness of Visual–Cervical Coordination Exercise Programs for Digital Device Users: A Systematic Review

Vedika A Karmarkar¹, S Anandh², Sakshi Jadhav³, Tanvi Bhujbal⁴

¹MPTh, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth (Deemed to be University)

²Professor and Head, Department of Community Health Sciences, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth (Deemed to be University)

Abstract—Prolonged use of smartphones, tablets, and computers requires sustained near-vision fixation combined with a flexed, forward-translated head posture. Because the eyes, the vestibular apparatus, and the cervical spine share dense afferent connections and act as a single sensorimotor unit for gaze stabilization and head-on-trunk control, this visual-cervical coupling is thought to be disrupted by prolonged screen exposure, contributing to neck pain, forward head posture, impaired balance, and visual discomfort in digital device users. Physiotherapy programs that specifically retrain visual-cervical coordination — eye-follow, gaze stability, eye-head coordination, and cervical repositioning exercises — have been proposed as a targeted way to address this shared pathway, as distinct from general strengthening or stretching-based neck rehabilitation.

Objective: To systematically evaluate the effectiveness of physiotherapy interventions targeting visual-cervical coordination for pain, disability, sensorimotor, and balance outcomes in digital device users.

Methods: PubMed, Google Scholar, Scopus, ScienceDirect, and Web of Science were searched for studies published between 2015 and 2026 linking physiotherapy or a physiotherapy-adjacent intervention to visual-cervical coordination, oculomotor function, or cervical proprioception in digital device users. Randomized controlled trials were appraised with the Revised Cochrane Risk of Bias tool (RoB 2); cross-sectional studies were appraised with AXIS. Ten studies met the eligibility criteria: eight trials and two cross-sectional studies.

Results: Visual-cervical coordination programs — eye-cervical re-education, gaze-stability and eye-head coordination exercises, oculomotor training, and virtual-reality-based proprioceptive games — consistently improved neck pain, disability, cervical range of motion, pressure pain thresholds, cervical joint position sense, and postural/balance control in digital device users, generally matching or exceeding craniocervical flexor training and stretching-based comparators. The two

cross-sectional studies confirmed that heavy digital device use is strongly associated with visual disorders, neck pain, and impaired static balance. Most trials were rated "some concerns" on RoB 2, primarily because blinding of participants was not feasible; the cross-sectional studies showed low risk of bias on AXIS, apart from sampling representativeness.

Conclusion: Physiotherapy that specifically trains visual-cervical coordination is an effective, low-risk approach to managing neck pain, sensorimotor deficits, and balance impairment in digital device users, and warrants inclusion as a targeted component of ergonomic and rehabilitation programs for this population.

Index Terms— cervical proprioception, digital device users, eye-head coordination, gaze stability, oculomotor exercise, physiotherapy, text neck, visual-cervical coordination.

I. INTRODUCTION

Neck pain is already one of the most common musculoskeletal complaints worldwide, and its prevalence and associated disability burden have continued to climb over the past three decades [1]. Smartphones, tablets, and computers have become central to work, education, and leisure, and daily screen time among students and young adults now regularly exceeds five hours. Extended use requires the eyes to remain fixed on a near target for long periods while the head is held in a flexed, forward-translated posture to bring the screen into the line of sight. This combination of sustained near-vision fixation and altered cervical alignment places unusual and prolonged demand on a system that was not built to hold still: the coupled visual-vestibular-cervical network that normally coordinates gaze and head movement during everyday activity.

The eyes, the vestibular apparatus, and the cervical spine are anatomically and functionally coupled. Cervical mechanoreceptors, particularly the muscle-spindle-rich suboccipital muscles, feed directly into the same central pathways that drive eye movement and postural control, and disruption at any point in this loop can produce cascading effects across the others [2]. Prolonged, visually demanding near-work has been shown to trigger measurable changes in neck muscle activity through this eye-neck linkage, independent of any change in seated posture [3]. In digital device users specifically, cross-sectional evidence shows that heavier screen exposure tracks closely with both visual disorders and neck pain, occurring together far more often than would be expected by chance [4], and that intensive smartphone use is strongly associated with impaired static balance, a function that itself depends on accurate visual-cervical integration [5].

Given this shared mechanism, a specific category of physiotherapy exercise has been developed to retrain the visual-cervical link directly, rather than relying only on general strengthening or stretching of the neck muscles. These programs typically combine eye-follow and gaze-stability drills, eye-head coordination exercises, and cervical repositioning or joint-position-sense training, building on the original eye-cervical re-education protocols first described for chronic neck pain [6]. Because these exercises target the visual and cervical systems together, they are conceptually distinct from craniocervical flexor training, manual therapy, or passive postural supports, and may be particularly relevant for people whose neck symptoms are driven by prolonged near-vision device use.

Despite growing interest in this approach, no existing review has drawn together the trial and cross-sectional evidence specifically around visual-cervical coordination training in digital device users. This review was undertaken to close that gap — to determine how effective physiotherapy interventions targeting visual-cervical coordination are for improving pain, disability, sensorimotor function, and balance in this population, and to identify where the evidence is strong and where it remains thin.

II. METHODOLOGY

A. Study Design

This review followed standard systematic-review methodology and the PRISMA 2020 reporting framework, and was confined to randomized controlled trials and cross-sectional studies examining physiotherapy interventions connected to visual-cervical coordination, oculomotor function, or cervical proprioception in digital device users or in populations with device-use-related neck pain. Trials were rated for bias using RoB 2; cross-sectional studies were rated using AXIS.

B. Search Strategy

The search aimed to capture any study connecting physiotherapy interventions to visual-cervical coordination, gaze stability, eye-head coordination, oculomotor function, cervical proprioception, or balance in digital device users. Coverage ran from January 2015 through 2026, across PubMed, Google Scholar, Scopus, ScienceDirect, and Web of Science. Search terms mixed MeSH headings with plain keywords — smartphone, digital device, text neck, computer vision syndrome, cervical proprioception, oculomotor exercise, gaze stability, eye-head coordination, visual-cervical coupling, neck pain, forward head posture — joined with AND/OR Boolean logic. Reference lists of relevant papers were hand-checked for studies the database search might have missed. Eligible study types were narrowed to English-language randomized trials and cross-sectional studies; case reports, narrative reviews, meta-analyses, and qualitative work were excluded from the outset.

C. Inclusion Criteria

A study was eligible if its participants were digital device users, or presented with neck pain, forward head posture, or balance impairment plausibly attributable to prolonged device use, and if it tested a physiotherapy or physiotherapy-related intervention with a visual-cervical coordination component: eye-follow or gaze-stability training, eye-head coordination exercise, cervical joint-repositioning or proprioceptive training, oculomotor exercise, or virtual-reality-based cervicocephalic training. Eligibility was further limited to English-language

trials and cross-sectional studies published from 2015 to 2026 with full text obtainable.

D. Exclusion Criteria

Studies were excluded if participants had neurological, vestibular, or ophthalmological disease unrelated to device use, or if the only intervention tested was purely structural or passive (manual therapy, taping, or bracing alone) with no visual or oculomotor training component. Case reports, narrative or systematic reviews, meta-analyses, qualitative research, conference abstracts lacking full text, and animal or cadaveric work were all excluded, as were studies that reused the same trial population and outcome data already captured by an included study.

E. Quality Assessment

Each study's methodological quality was scored with a tool matched to its design. RoB 2 was used across the eight trials, checking for bias tied to the randomization process, deviations from the planned intervention, missing outcome data, how outcomes were measured, and whether results were reported selectively. AXIS was applied to the two cross-sectional studies, covering the clarity of aims, sample selection, validity of measurement tools, statistical approach, reporting quality, ethical considerations, and the chance of non-response bias skewing the findings.

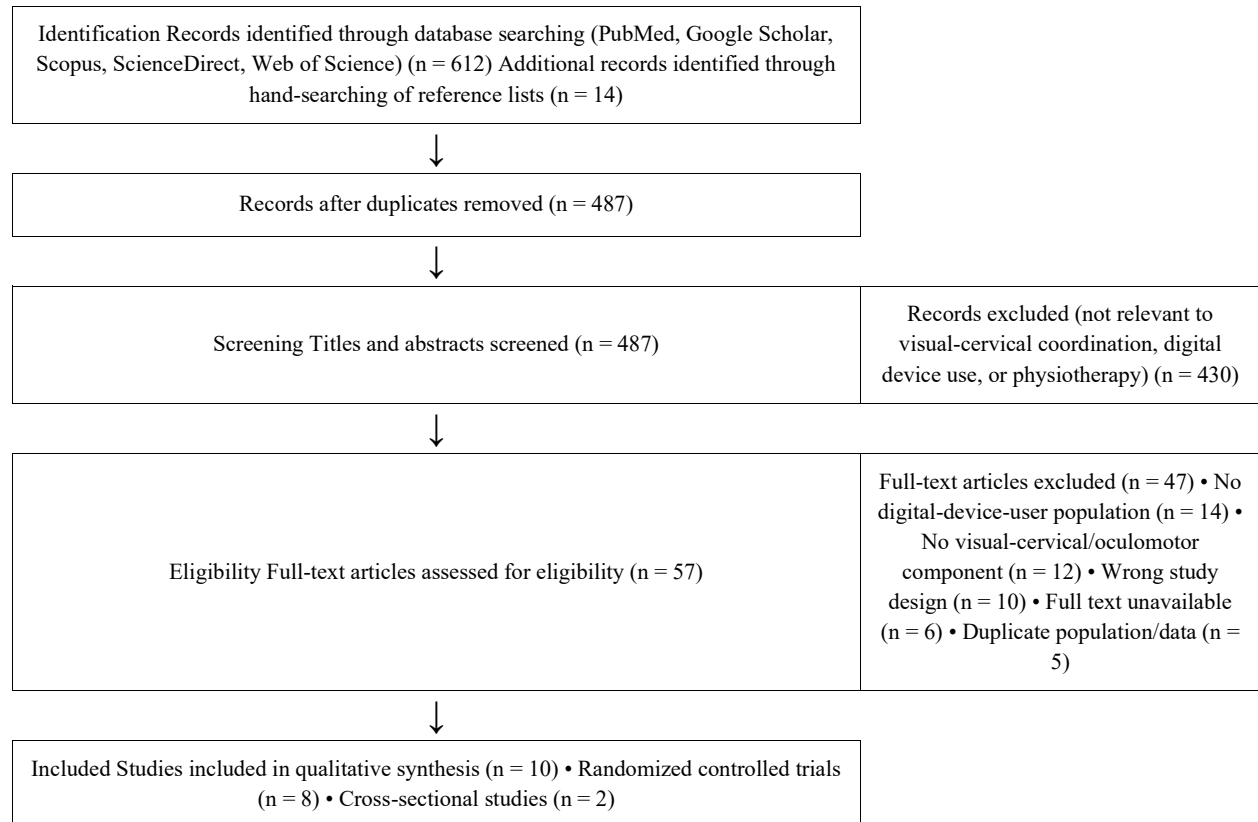


Fig. 1. PRISMA 2020 flow diagram of study identification and selection.

III. RESULT

Ten studies cleared the eligibility bar for this review — eight randomized trials and two cross-sectional studies — together sketching a wide-angle view of

how physiotherapy is currently used to retrain visual-cervical coordination in digital device users. The study-selection process is summarized in the PRISMA flow diagram (Fig. 1). Every study appears exactly once in Table I.

TABLE I SUMMARY OF INCLUDED STUDIES

Author(s)/Year	Design	N	Outcome Measures	Interventions	Results	Conclusion
Pérez-Cabezas V et al [7]	RCT	44	Pressure pain threshold (trapezius, levator scapulae, splenius capitis), cervical ROM, VAS, McGill Questionnaire	Eye-Cervical Re-education Program (eye-follow, head reposition, oculocervical coordination) added to multimodal physiotherapy, vs multimodal physiotherapy alone	The eye-cervical group showed significantly greater gains in pressure pain threshold over the upper trapezius and splenius capitis and in cervical range of motion in every plane; VAS and McGill scores improved in both groups with no between-group difference	Eye-cervical coordination training adds meaningful gains in pain sensitivity and mobility on top of standard physiotherapy
Rezaei I et al [8]	RCT	44	VAS pain, Neck Disability Index, Y-balance test	Virtual-reality Cervigame® (game-based eye-head-neck coordination) vs conventional proprioceptive training (eye-follow, gaze stability, eye-head coordination, position/movement sense)	Both groups improved significantly in pain, disability, and dynamic balance immediately after and 5 weeks after the intervention, with no significant difference between groups	Game-based visual-cervical coordination training is as effective as conventional proprioceptive training and may improve engagement through gamification
Wah SW et al [9]	RCT	42	Balance Error Scoring System, cervical joint position sense,	Proprioceptive training (gaze stability, eye-head coordination,	The proprioceptive training group showed significantly	Visual-cervical proprioceptive training outperforms

Author(s)/Year	Design	N	Outcome Measures	Interventions	Results	Conclusion
			craniocervical flexion test, VAS	position/movement sense) vs craniocervical flexor training vs control, in university student smartphone users	greater improvement in static balance and cervical joint position sense than the craniocervical-flexor and control groups; both active groups reduced neck pain relative to control	craniocervical flexor training alone for balance impairment in smartphone users
Farooq M et al [10]	RCT	40	Numeric Pain Rating Scale, Neck Disability Index, Smartphone Addiction Scale	ELDOA postural elongation technique vs post-facilitation stretching, in mobile users with text neck syndrome	Both groups improved significantly; the ELDOA group showed greater reductions in pain and disability at 6 weeks, with no between-group difference in smartphone addiction score	Postural elongation techniques outperform stretching alone for text neck syndrome, though neither directly reduces device dependency
Rezaee Dareh-deh H et al [11]	RCT	60	VAS pain, forward head angle, EMG (upper trapezius, sternocleidomastoid, scalene, cervical erector spinae), respiratory pattern	Therapeutic exercise routine with or without respiratory exercises vs control, in smartphone users with forward head posture and chronic neck pain	Both active groups reduced pain, forward head angle, and superficial neck muscle activity relative to control; adding respiratory exercise gave extra benefit	Postural-respiratory integration adds physiological but not additional pain-relief benefit over standard cervical exercise in digital device users

Author(s)/Year	Design	N	Outcome Measures	Interventions	Results	Conclusion
					for diaphragm activation and respiratory balance but not for pain or forward head angle beyond the routine alone	
Canlı K et al [12]	RCT	57	Pain intensity, Neck Disability Index, pressure pain threshold, temporal summation, conditioned pain modulation	Tactile discrimination training vs oculomotor exercises vs control, in people with chronic neck pain	Both the tactile-discrimination and oculomotor-exercise groups improved pain and disability relative to control; oculomotor exercise produced comparable or slightly better improvement in central pain-modulation measures	Oculomotor (visual-cervical) exercise is an effective standalone somatosensory intervention for chronic neck pain
Aggarwal A et al [13]	RCT	Not reported	Neck pain, Neck Disability Index, gaze stability, visual-complaint questionnaire	Oculomotor exercise program, in people with chronic neck pain and associated visual complaints	Oculomotor exercises significantly reduced neck pain, disability, and self-reported visual complaints, and improved gaze stability	Oculomotor training directly targets the visual-complaint component of neck pain that is common in digital device users

Author(s)/Year	Design	N	Outcome Measures	Interventions	Results	Conclusion
Goudarzi L et al [14]	RCT	90 (60 CNSNP + 30 asymptomatic)	Center-of-pressure variables under normal, foam, cervical-extension eyes-open, and cervical-extension eyes-closed standing conditions	Cervical proprioceptive training added to conventional physiotherapy vs conventional physiotherapy alone, compared against asymptomatic controls	Adding proprioceptive training normalized visual, vestibular, and proprioceptive-dependent postural control to near-asymptomatic levels; pain intensity did not differ between the two treatment groups	Visual-cervical proprioceptive training recalibrates sensory reliance for postural control independently of pain relief
Wah SW et al [5]	Cross-sectional	81	Balance Error Scoring System, self-reported smartphone-use questionnaire, Neck Disability Index	University student smartphone users with subclinical neck pain were assessed for prevalence and risk factors of static balance impairment	Static balance impairment was present in 74.07% of participants; daily use ≥ 4 hours, ≥ 4 years of use, and NDI ≥ 7 were significant independent risk factors	High-intensity smartphone use is strongly associated with sensorimotor and balance impairment, supporting a visual-cervical coordination deficit model
Almutairi H et al [4]	Cross-sectional	263	Neck Disability Index, self-reported visual-disorder and screen-time questionnaire	University students were assessed for the prevalence and interrelationship of screen time, visual disorders, and neck pain	Visual disorders were present in 62.0% and neck pain in 79.5% of participants; more than 5 hours of daily screen use and female	Visual disorders and neck pain co-occur at high rates among heavy digital device users, reinforcing the shared visual-cervical

Author(s)/Year	Design	N	Outcome Measures	Interventions	Results	Conclusion
					sex were associated with higher neck disability scores	pathway rationale for targeted intervention

A. Assessment of Risk of Bias

Every study included here was checked for bias using a tool matched to its design, as a way of grounding confidence in what the pooled results show.

On the RoB 2 scale, most trials scored a low risk of bias for the randomization process itself, for how missing outcome data was handled, and for whether results were reported selectively. What proved harder was blinding — keeping participants, and in several cases the people scoring outcomes, unaware of which group they were in — since that is rarely feasible when the intervention is a hands-on eye-head coordination

technique, a game the patient can see, or a self-guided exercise plan. That gap left most of the eight trials flagged for "some concerns" around deviations from the planned intervention, and several were also flagged for outcome measurement wherever the outcome relied on self-report, such as pain or visual-complaint ratings. Weighing everything together, every one of the eight trials landed at an overall rating of "some concerns" — a fair reflection of decent quality held back by the performance and detection bias that is almost unavoidable in physiotherapy research (Table II).

TABLE II RISK OF BIAS ASSESSMENT USING THE ROB 2 TOOL

Study	Randomization	Deviations from Intervention	Missing Outcome Data	Measurement of Outcome	Selection of Result	Overall Risk
Pérez-Cabezas V et al (2020)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Rezaei I et al (2019)	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Wah SW et al (2021)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Farooq M et al (2023)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Rezaee Dareh-deh H et al (2022)	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Canlı K et al (2025)	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Aggarwal A et al (2024)	Low Risk	Some Concerns	Some Concerns	Some Concerns	Low Risk	Some Concerns
Goudarzi L et al (2024)	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns

Quality held up well across the two cross-sectional studies under the AXIS checklist. Both stated their aims plainly, matched their design to those aims, defined the target population clearly, and used an appropriate sampling frame. Both leaned on outcome tools with an established track record — the Balance Error Scoring System and the Neck Disability Index — backed by suitable statistics, and each explained its

methods, results, limitations, and ethics approval clearly enough to follow. The soft spot in both was how representative the samples were, since each study drew from a single university, and neither said much about who did not respond or how that gap was handled. Bias overall came out low for the cross-sectional group, with selection and non-response the two issues worth flagging (Table III).

TABLE III QUALITY ASSESSMENT OF INCLUDED CROSS-SECTIONAL STUDIES USING THE AXIS TOOL

AXIS Appraisal Question	Wah SW et al (2022)	Almutairi H et al (2024)
Were the aims/objectives of the study clear?	Yes	Yes
Was the study design appropriate for the aims?	Yes	Yes
Was the sample size justified?	Some Concerns	Yes
Was the target population clearly defined?	Yes	Yes
Was the sampling frame appropriate?	Yes	Yes
Was the selection process representative?	Some Concerns	Some Concerns
Were measures taken to address non-responders?	No	No
Were the outcome variables measured appropriately?	Yes	Yes
Were the tools piloted/previously published?	Yes	Yes
Was statistical significance clearly determined?	Yes	Yes
Were the methods described in enough detail?	Yes	Yes
Were the basic data adequately described?	Yes	Yes
Is there concern regarding non-response bias?	Some Concerns	Some Concerns
Was information about non-respondents described?	No	No
Were the results internally consistent?	Yes	Yes
Were all method-defined results presented?	Yes	Yes
Were discussions and conclusions justified?	Yes	Yes
Were the study limitations discussed?	Yes	Yes
Were funding/conflicts of interest reported?	Yes	Yes
Was ethical approval/informed consent attained?	Yes	Yes

IV. DISCUSSION

The question at the heart of this review was straightforward: does physiotherapy that specifically retrains visual-cervical coordination actually help digital device users? Pulling together eight trials and two cross-sectional studies, the answer leans clearly toward yes — programs built around eye-follow, gaze stability, eye-head coordination, and cervical repositioning deliver real gains in pain, disability, cervical mobility, and sensorimotor control, while the cross-sectional evidence confirms that heavy device use disturbs the visual-cervical system in the first place.

Pérez-Cabezas V and co-authors found that layering an Eye-Cervical Re-education Program onto standard multimodal physiotherapy produced significantly greater gains in pressure pain threshold and cervical range of motion than multimodal physiotherapy alone [7]. That fits with the idea that eye-head coordination exercises recruit the suboccipital and craniocervical musculature more precisely than passive modalities or massage alone, improving the quality of cervical afferent input into the central nervous system. Aggarwal A and co-authors reinforced this from the symptom side: oculomotor exercise alone reduced neck pain, disability, and self-reported visual complaints while improving gaze stability, directly targeting the visual-complaint cluster that so often accompanies device-related neck pain [13].

Comparative trials suggested visual-cervical training holds its own against, and sometimes outperforms, more conventional neck-focused approaches. Wah SW and co-authors found that proprioceptive training built around gaze stability and eye-head coordination produced significantly better static balance and cervical joint position sense than craniocervical flexor training in university student smartphone users [9], while Canlı K and co-authors showed that oculomotor exercise matched or slightly outperformed tactile discrimination training on central pain-modulation measures in chronic neck pain [12]. Rezaei I and co-authors found that a gamified virtual-reality version of visual-cervical training (Cervigame®) performed comparably to conventional proprioceptive training on pain, disability, and dynamic balance, hinting that the coordination content of the exercise, more than its delivery format, may be what drives the benefit [8].

Not every comparison favored the visual-cervical component outright. Farooq M and co-authors found that a postural elongation technique (ELDOA) outperformed simple stretching for pain and disability in mobile users with text neck syndrome, but neither approach reduced smartphone addiction scores, underlining that structural exercise can ease symptoms without changing the device-use behavior driving them [10]. Rezaee Dareh-deh H and co-authors found that adding respiratory exercises to a standard therapeutic routine improved diaphragm activation and respiratory balance in smartphone users with forward head posture, but gave no extra benefit for pain or forward head angle beyond the routine program itself, suggesting respiratory integration adds physiological value without necessarily adding analgesic value [11].

The most mechanistically direct finding came from Goudarzi L and co-authors, who added cervical proprioceptive training to conventional physiotherapy in chronic non-specific neck pain and measured postural control directly under manipulated visual and cervical-afferent conditions. Adding proprioceptive training normalized visual-, vestibular-, and proprioceptive-dependent postural control to levels close to asymptomatic controls, even though pain intensity itself did not differ between the treatment groups [14]. That dissociation matters: it suggests visual-cervical training recalibrates the sensory weighting system that digital device use disrupts, independent of whatever is driving the pain itself, and that pain relief and sensorimotor recalibration may need to be tracked as separate outcomes in future trials. The cross-sectional studies help explain why this training target makes sense in the first place. Wah SW and co-authors found static balance impairment in 74.07% of university student smartphone users with subclinical neck pain, with daily use of four hours or more, four or more years of use, and higher disability scores all independently predicting impairment [5]. Almutairi H and co-authors found visual disorders in 62.0% and neck pain in 79.5% of university students, with more than five hours of daily screen use associated with higher disability scores [4]. Together, these figures describe exactly the population that visual-cervical coordination training is designed for: people whose visual and cervical systems are both under sustained load from the same behavior.

Put together, the evidence in Table I suggests physiotherapy that actively trains the visual-cervical link — eye-follow, gaze stability, eye-head coordination, and cervical repositioning, whether delivered manually or through a virtual-reality game — delivers consistent benefit for pain, disability, and sensorimotor control in digital device users, and does at least as well as, and sometimes better than, craniocervical flexor training, stretching, or respiratory adjuncts on these outcomes. The cross-sectional data support giving this training a clear place in ergonomic and rehabilitation programs for heavy device users, given how common combined visual and cervical impairment already is in this group before any pain even develops.

A few limitations are worth flagging. The included trials differed considerably in intervention content, dose, and duration, and in which outcomes they measured, which makes direct comparison difficult. Several trials worked with small samples, and one did not report its sample size at all, which limits how broadly the findings can be applied. Blinding of participants was practically impossible for exercise-based interventions, which is why every trial picked up "some concerns" for deviations from the intended intervention. The two cross-sectional studies, while well designed, both drew from a single university and did not examine non-response bias, and their design rules out any causal claims about screen time and visual-cervical dysfunction. None of the included studies followed participants much beyond a few weeks post-intervention, so it remains an open question whether gains in coordination and balance persist once device-use habits resume.

None of that undercuts the overall picture: methodological quality across the included studies sat at moderate to good, and every trial pointed toward positive outcomes from visual-cervical coordination training in some combination of pain, disability, mobility, or sensorimotor measures. What would help going forward is larger, properly powered trials in explicitly device-defined populations, using standardized visual-cervical outcomes — gaze stability, cervical joint position sense, and objective screen-time tracking — followed for longer, to settle exactly what dose and format of training works best and whether the benefits hold once people return to their devices.

V. CONCLUSION

Physiotherapy that targets visual-cervical coordination — eye-cervical re-education, gaze-stability and eye-head coordination exercises, oculomotor training, and virtual-reality-based proprioceptive games — tracks with better pain control, improved cervical mobility, and stronger sensorimotor and balance outcomes in digital device users, generally matching or outperforming craniocervical flexor training and stretching-based approaches on these measures. Cross-sectional data confirm that heavy digital device use is already associated with high rates of combined visual and cervical impairment, reinforcing the rationale for training the two systems together rather than the neck alone. Altogether, this supports weaving visual-cervical coordination exercise into standard ergonomic and physiotherapy care for digital device users, with particular attention to gaze stability and eye-head coordination training. What is still needed is larger, standardized trials with longer follow-up to confirm how durable these benefits are once habitual device use resumes.

ACKNOWLEDGMENT

The authors thank the departmental faculty who supported the literature search and quality-appraisal process for this review.

REFERENCES

- [1] Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJM, Kolahi AA, Safiri S, "Neck pain: global epidemiology, trends and risk factors," *BMC Musculoskelet Disord*, vol. 23, p. 26, 2022.
- [2] Treleaven J, "Sensorimotor disturbances in neck disorders affecting postural stability, head and eye movement control," *Man Ther*, vol. 13, no. 1, pp. 2-11, 2008.
- [3] Richter HO, Zetterlund C, Lundqvist L-O, "Eye-neck interactions triggered by visually deficient computer work," *Work*, vol. 39, no. 1, pp. 67-78, 2011.
- [4] Almutairi H, Alhammad L, Aldossari B, Alonazi A, "Prevalence and interrelationships of screen time, visual disorders, and neck pain among university students: a cross-sectional study at

- Majmaah University," *Healthcare (Basel)*, vol. 12, no. 20, p. 2067, 2024.
- [5] Wah SW, Chatchawan U, Chatprem T, Puntumetakul R, "Prevalence of static balance impairment and associated factors of university student smartphone users with subclinical neck pain: cross-sectional study," *Int J Environ Res Public Health*, vol. 19, no. 17, p. 10723, 2022.
- [6] Revel M, Minguet M, Gregoy P, Vaillant J, Manuel JL, "Changes in cervicocephalic kinesthesia after a proprioceptive rehabilitation program in patients with neck pain: a randomized controlled study," *Arch Phys Med Rehabil*, vol. 75, no. 8, pp. 895-899, 1994.
- [7] Pérez-Cabezas V, Ruiz-Molinero C, Jimenez-Rejano JJ, Chamorro-Moriana G, Gonzalez-Medina G, Chillon-Martinez R, "Effectiveness of an eye-cervical re-education program in chronic neck pain: a randomized clinical trial," *Evid Based Complement Alternat Med*, vol. 2020, p. 2760413, 2020.
- [8] Rezaei I, Razeghi M, Ebrahimi S, Kayedi S, "A novel virtual reality technique (Cervigame®) compared to conventional proprioceptive training to treat neck pain: a randomized controlled trial," *J Biomed Phys Eng*, vol. 9, no. 3, pp. 355-366, 2019.
- [9] Wah SW, Puntumetakul R, Boucaut R, "Effects of proprioceptive and craniocervical flexor training on static balance in university student smartphone users with balance impairment: a randomized controlled trial," *J Pain Res*, vol. 14, pp. 1935-1947, 2021.
- [10] Farooq M, Bashir MS, Arif A, Kashif M, Manzoor N, Abid F, "Effects of elongation longitudinaux avec decoaptation osteo-articulaire and post-facilitation stretching technique on pain and functional disability in mobile users with text neck syndrome during COVID-19 pandemic: a randomized controlled trial," *Medicine (Baltimore)*, vol. 102, no. 12, p. e33073, 2023.
- [11] Rezaee Dareh-deh H, Hadadnezhad M, Letafatkar A, Peolsson A, "Therapeutic routine with respiratory exercises improves posture, muscle activity, and respiratory pattern of patients with neck pain: a randomized controlled trial," *Sci Rep*, vol. 12, p. 4149, 2022.
- [12] Canlı K, Demirkıran G, Can F, "The efficiency of tactile discrimination training and oculomotor exercises in people with chronic neck pain: a randomized controlled trial," *BMC Musculoskelet Disord*, vol. 26, p. 519, 2025.
- [13] Aggarwal A, Thakur J, Palekar TJ, "Effect of oculomotor exercises in patients with non-specific chronic neck pain and associated visual complaints," *Hong Kong Physiother J*, vol. 44, no. 1, pp. 21-27, 2024.
- [14] Goudarzi L, Ghomashchi H, Vahedi M, Kahlaee AH, "Investigating the effect of addition of cervical proprioceptive training to conventional physiotherapy on visual, vestibular and proprioceptive dependency of postural control in patients with chronic non-specific neck pain: a randomized controlled clinical trial," *Arch Bone Jt Surg*, vol. 12, no. 1, pp. 36-50, 2024.