



JOURNAL
Of Universal Applied
Research

ISSN (Online): XXX
Vol. 01, Issue 02 (2026)
<https://universalappliedresearch.com/index.php/JUAR/issue/archive>

Bifocal and Multifocal Spectacles in Spine and Orthopaedic Surgery

Dr Nishant

MS Orthopaedics, D Ortho, Assistant Professor, Department of Orthopaedic Surgery, NSMCH, Bihta, Bihar, Author's Email: nishantorthospine2014@gmail.com

Orcid ID: <https://orcid.org/0000-0002-6206-7732>

Received:- 21/07/2026 Revised:- 24/08/2026 Accepted:- 05/09/2026
Published:- 16/09/2026

Abstract

Presbyopia is common among experienced surgeons and may influence operative posture because bifocal and progressive-addition lenses require the wearer to align the visual target with a restricted near-vision zone. This issue may be particularly relevant to spine and orthopaedic surgery, where surgeons often maintain constrained head and trunk positions while viewing a deep operative field, fluoroscopic monitors, navigation displays, or instruments at different working distances. A focused review of PubMed-indexed literature identified evidence that bifocal and multifocal spectacles alter cervical posture in non-surgical tasks, a surgeon-specific review describing the ergonomic impact of presbyopia, and a small surgical study showing that prismatic spectacles can reduce neck flexion and discomfort. No direct comparative study was identified in spine or orthopaedic surgeons during live surgery. The available evidence supports task-specific optical assessment rather than assuming that everyday bifocal or progressive spectacles are optimal in the operating room. Prospective crossover studies should compare conventional multifocal lenses with task-specific single-vision, occupational, loupe-mounted, and prismatic systems using objective posture, muscle-load, visual-performance, and procedural outcomes.

Keywords: presbyopia; bifocal spectacles; progressive lenses; spine surgery; orthopaedic surgery; surgical ergonomics; cervical posture

Introduction

Surgical ergonomics has become an important occupational-health concern because sustained neck flexion, shoulder elevation, trunk inclination, and static muscular loading are common during open and minimally invasive procedures. Spine and orthopaedic surgeons may be especially exposed during long operations, deep-field visualization, fluoroscopy-guided instrumentation, microscope use, and alternating attention between the wound and multiple displays. Visual correction is a potentially modifiable part of this environment.

Presbyopia reduces near focusing ability with age. Bifocal and progressive-addition spectacles restore near vision through a lower lens segment or corridor, but the wearer must direct the eyes and often the head toward a particular portion of the lens. When the target lies at an unusual height or distance, clear vision may therefore require cervical extension, flexion, or repeated head movement. These optical demands may interact with an already constrained operative posture. This narrative review summarizes the literature relevant to bifocal and multifocal spectacle use, cervical posture, and surgeon ergonomics, with particular attention to implications for spine and orthopaedic surgery. It also defines the limitations of current evidence and proposes a practical research agenda.

Evidence Review

Bifocal and multifocal lenses alter head and cervical posture

Martin and Dain studied presbyopic visual-display-unit operators who reported neck or back aching and asthenopia. Head movements between keyboard and screen were two to three times greater with bifocal spectacles than with specially prescribed single-vision occupational spectacles. The authors attributed symptoms to static loading of the neck and back muscles associated with bifocal use. Although the workstation differs from an operating room, the underlying mechanism is relevant: a restricted near segment can force the head to compensate when the visual target is not aligned with the appropriate lens zone.¹

Abbas and colleagues used lateral cervical radiographs in 30 adults with presbyopia while they performed a reading task with unifocal and multifocal lenses. Multifocal wear produced greater extension at several upper and lower cervical measurements, whereas unifocal wear produced greater flexion at selected mid-cervical segments. The study demonstrates that lens design can measurably redistribute cervical posture, but it did not assess surgeons, prolonged exposure, symptoms, or clinical outcomes.²

An earlier report explicitly proposed bifocal spectacles as a contributor to cervical radiculopathy. The article is historically notable but has no PubMed abstract and predates contemporary lens designs and modern diagnostic standards; it should therefore be interpreted as hypothesis-generating rather than causal evidence.³

Evidence in surgeons

A recent surgical perspective by Zhang, Boland, and Chrouser describes presbyopia as an ergonomic issue for surgeons and outlines management considerations. It is the most directly relevant publication for surgical practice, but it is not a spine- or orthopaedic-specific comparative trial.⁴

Kuang and colleagues evaluated prismatic glasses during cleft-palate surgery in a within-surgeon study involving three oral and maxillofacial surgeons and six operations. Prismatic glasses reduced time spent in pronounced neck flexion and lowered self-reported neck, shoulder, and back discomfort. Operative time and blood loss were not significantly different. The small sample and procedure-specific setting limit generalizability, but the study provides proof of concept that redirecting the visual axis can improve intraoperative posture without an obvious performance penalty.⁵

Orthopaedic eye protection is a separate requirement

Prescription spectacles should not be treated as adequate protective eyewear. In a simulated orthopaedic model using femoral osteotomy, conventional prescription glasses had an 83% conjunctival-contamination rate, equal to the unprotected control condition. Disposable protective glasses performed best among the tested devices. Optical correction, ergonomic design, splash protection, and radiation protection should therefore be planned as compatible but distinct functions.⁶

Relevance to Spine and Orthopaedic Surgery

The evidence can reasonably be extrapolated at the level of biomechanical mechanism, but not at the level of proven clinical benefit. In spine surgery, the operative target may lie below eye level while the surgeon alternates among direct vision, magnifying loupes or microscope oculars, fluoroscopy, navigation, and neuromonitoring displays. In arthroplasty and trauma surgery, visual demands similarly vary between a deep field, instrument markings, overhead monitors, and C-arm images. A conventional bifocal may be satisfactory for one distance yet encourage repeated cervical adjustment for another.

This interaction is likely to depend on lens-segment height, working distance, operating-table height, monitor position, surgeon stature, use of loupes or headlamps, and the duration of static work. Consequently, “bifocal versus no bifocal” is too simple a comparison. The clinically relevant question is whether the optical system is matched to the procedure and workstation.

Practical Implications

Operative demand	Potential optical problem	Practical response
Deep field below eye level	Near segment may require head extension or an awkward gaze angle	Measure the actual working distance and target height; consider task-specific single-vision or occupational lenses.
Alternating field and monitor viewing	Repeated switching across lens zones may increase head movement	Position monitors within a neutral visual envelope and test the complete field-to-display sequence.
Loupes microscope or headlamp	Everyday spectacles may conflict with focal distance, declination angle, or equipment fit	Coordinate prescription, loupe focal length, declination angle, table height, and head-mounted equipment.
Fluoroscopy intensive work	Ordinary prescription spectacles do not provide radiation protection	Use appropriately fitted leaded eyewear when indicated; integrate the prescription without compromising coverage.
Splash or debris risk	Prescription spectacles alone provide inadequate protection	Add certified wraparound protection or a face shield compatible with the corrective system.

A surgeon with new neck discomfort after changing lenses should consider the spectacles as one component of a broader ergonomic assessment. Lens prescription, fit, segment position, target distance, monitor height, table height, and magnification setup should be reviewed together. Symptomatic surgeons should receive individualized clinical evaluation; the present evidence does not establish that changing spectacles alone treats cervical radiculopathy or other spinal disease.

Research Priorities

The central evidence gap is the absence of a direct study in spine or orthopaedic surgeons during operative work. A prospective randomized crossover design would be feasible. Surgeons with presbyopia could perform standardized cadaveric, simulation, or selected clinical tasks using conventional progressive or bifocal spectacles, task-specific single-vision lenses, and an optimized occupational or prismatic system. Each condition should be matched to the same refraction and tested after an appropriate adaptation period.

Primary outcomes should include time spent beyond predefined cervical-flexion and extension thresholds, head excursion, and neck or trapezius muscle activity measured with wearable inertial sensors and surface electromyography. Secondary outcomes should include visual acuity at each operative distance, depth perception, error rate, task completion time, discomfort, fatigue, workflow disruption, and device compatibility. Procedure type, surgeon height, table height, monitor location, loupe declination angle, and prior cervical symptoms should be prespecified covariates.

A clinically useful study should also examine whether optical optimization has a cumulative benefit across a full operating day and whether improvements persist after several weeks. Patient-safety and procedural-performance measures are essential because postural comfort alone cannot establish that an optical system is appropriate for surgery.

Limitations of the Available Evidence

The literature is heterogeneous and mostly indirect. Key posture studies were performed during reading or computer work rather than surgery. The surgical prismatic-glasses study included only three surgeons and a small number of operations. Older reports may not reflect current progressive-lens technology. The search supporting this narrative review was focused rather than systematic, and publication bias is possible. No evidence currently demonstrates that conventional bifocal or multifocal spectacles cause cervical disease in spine or orthopaedic surgeons, nor that one lens design improves patient outcomes.

Conclusion

Bifocal and multifocal spectacles can alter cervical posture because clear near vision depends on alignment with a restricted portion of the lens. This mechanism is relevant to spine and orthopaedic surgery, where visual targets occur at multiple heights and distances during prolonged, constrained work. Current evidence supports individualized, task-specific optical and ergonomic assessment, but it does not identify a superior lens design for these specialties. A direct crossover study in spine and orthopaedic surgeons is warranted and should integrate posture, muscle load, visual performance, procedural accuracy, comfort, and safety.

References

1. Martin DK, Dain SJ. Postural modifications of VDU operators wearing bifocal spectacles. *Appl Ergon*. 1988;19(4):293–300. doi:10.1016/0003-6870(88)90077-4. PMID:15676671.
2. Abbas RL, Houry MT, Rayyan MM, Hamada HA, Saab IM. Effect of unifocal versus multifocal lenses on cervical spine posture in patients with presbyopia. *Int J Occup Saf Ergon*. 2019;25(1):148–152.

doi:10.1080/10803548.2018.1459349. PMID:29616886.

3. Johnson EW, Wolfe CV. Bifocal spectacles in the etiology of cervical radiculopathy. *Arch Phys Med Rehabil.* 1972;53(5):201–205. PMID:5029399.
4. Zhang AD, Boland B, Chrouser KL. Presbyopia in surgeons: ergonomic impact and tips for management. *Ann Surg.* 2024;280(6):935–937. doi:10.1097/SLA.0000000000006323. PMID:38716663.
5. Kuang H, Chen G, Wen Q, Li S, Chen L, Liang F. Improving surgeons' comfort with prismatic glasses during cleft palate surgery: preliminary findings. *J Oral Maxillofac Surg.* 2017;75(7):1527.e1–1527.e8. doi:10.1016/j.joms.2017.03.033. PMID:28431235.
6. Mansour AA III, Even JL, Phillips S, Halpern JL. Eye protection in orthopaedic surgery: an in vitro study of various forms of eye protection and their effectiveness. *J Bone Joint Surg Am.* 2009;91(5):1050–1054. doi:10.2106/JBJS.H.00460. PMID:19411452.