

Prevalence of Work Related Musculoskeletal Disorders and Quantification of Ergonomic Hazards Among Optometrists In Chennai- A Cross Sectional Study

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Abstract

Introduction: Optometrists have to perform precision-based clinical tasks, which often require prolonged static sitting, sustained awkward postures, and repetitive movements. These frequent biomechanical demands can lead to work-related musculoskeletal disorders (WMSDs). Despite high prevalence of WMSDs globally, very limited research is available for Indian optometrists, particularly, among those who are working in tertiary eye care hospital. Thus, this present study aimed to determine the prevalence of work-related musculoskeletal disorders (WMSDs) and to quantify working posture-related ergonomic risks among optometrists in a high-volume tertiary eye care setting. **Methods:** A cross-sectional observational study was conducted in July, 2025 at five departments of a tertiary eye care hospital, Chennai. Ergonomic risks were evaluated using direct observation, videography, workstation measurements, the Nordic Musculoskeletal Questionnaire (NMQ), and Rapid Upper Limb Assessment (RULA). **Results:** The chronic prevalence of discomfort was neck flexion ($>20^\circ$ for 45 ± 12 min/hour) and prolonged shoulder elevation were common. Over 70% of participants lacked formal ergonomic training and reported fatigue within 2–3 hours of continuous clinical work. **Conclusion:** This study is an evidence of existing scenario, and study findings will help future researchers to plan intervention strategies.

Keywords: Optometry, Ergonomics, Work-related musculoskeletal disorders, RULA, Nordic Musculoskeletal Questionnaire

Prevalencia de trastornos musculoesqueléticos relacionados con el trabajo y cuantificación de riesgos ergonómicos entre optometristas en Chennai: un estudio transversal

Resumen

Introducción: Los optometristas deben realizar tareas clínicas de precisión que a menudo requieren estar sentados estáticamente durante períodos prolongados, posturas incómodas sostenidas y movimientos repetitivos. Estas frecuentes demandas biomecánicas pueden conducir a trastornos musculoesqueléticos relacionados con el trabajo (WMSD). A pesar de la alta prevalencia de WMSD a nivel mundial, la investigación disponible para optometristas indios, en particular, entre aquellos que trabajan en hospitales de atención oftalmológica terciaria. Por lo tanto, este estudio tuvo como objetivo determinar la prevalencia de trastornos musculoesqueléticos relacionados con el trabajo (WMSD) y cuantificar los riesgos ergonómicos relacionados con la postura de trabajo entre optometristas en un entorno de atención oftalmológica terciaria de alto volumen. **Métodos:** Se realizó un estudio observacional transversal en julio de 2025 en cinco departamentos de un hospital de atención oftalmológica terciaria, Chennai. Los riesgos ergonómicos se evaluaron mediante observación directa, videografía, mediciones en la estación de trabajo, el Cuestionario Musculoesquelético Nórdico (NMQ) y la Evaluación Rápida de las Extremidades Superiores (RULA). **Resultados:** La prevalencia crónica de molestias fue la flexión cervical

(>20° durante 45 ± 12 min/h) y la elevación prolongada del hombro. Más del 70 % de los participantes carecía de formación ergonómica formal y reportaron fatiga entre 2 y 3 horas de trabajo clínico continuo. **Conclusión:** Este estudio evidencia la situación actual y sus hallazgos ayudarán a futuros investigadores a planificar estrategias de intervención.

Palabras Clave: Optometría, Ergonomía, Trastornos musculoesqueléticos relacionados con el trabajo, RULA, Cuestionario Nórdico Musculoesquelético

Introduction

Ergonomics or Human Factor, the multidisciplinary science focused on optimizing the interaction between people and their work environment, for improving workplace safety, efficiency, and health (Bridger, 2018). In the healthcare sector, particularly in eye care fields like optometry and ophthalmology, the proper application of ergonomic principles is often overlooked despite significant demands placed on eye clinicians. Everyday tasks involving awkward posture, prolonged static postures, repetitive movements, and suboptimal workstation designs can lead to the development of Work-Related Musculoskeletal Disorders (WMSDs) (Da Costa & Vieira, 2010; McAtamney & Corlett, 1993).

Worldwide, studies have reported that the prevalence of musculoskeletal complaints among optometrists is notably high, with neck, shoulder, and lower back pain being most common (Pearce, 2017; Punnett & Wegman, 2004). Optometrists, who routinely engage in eye examinations, diagnostic testing, along with data entry, are especially vulnerable to WMSDs. These disorders not only affect the wellbeing of the clinician but also negatively impact clinical productivity and quality of patient care (Schechet, 2020; Shieh *et al.*, 2016). So, the study aimed to determine the prevalence of work-related musculoskeletal disorders (WMSDs) among Optometrists and to quantify posture-related risks. The objective is to enhance occupational health, reduce physical strain, and foster long-term sustainability in optometric practice.

Materials and Methods

This is a cross-sectional observational study, conducted to evaluate prevalence of work related musculoskeletal disorders and ergonomic risk hazards behind WMSDs among optometrists. The study was conducted in the month of July at tertiary eye care hospital, Chennai, across multiple departments within the hospital, including Optical Coherence Tomography (OCT), Paediatric OPD, LASIK workup, Glaucoma clinic, and Pre-Cataract/IOL clinic. The routine job of Optometrists included patient evaluation, diagnostic imaging, and clinical documentation at least for 7 hours daily (Donahue, 2016; Weinreb, 2014). The evaluation was based on a mixed-method approach combining both qualitative and quantitative ergonomic assessment tools. After taking proper consent, twelve optometrists from five departments were randomly selected after considering inclusion and exclusion criteria. The age of participant ranged between 25 to 40 Years.

Brief about Assessed Departments at Tertiary Eye Care Hospital, Chennai

In the OCT or Optical Coherence Tomography department, optometrists perform patient verification, focus adjustment, scan protocol selection, image quality assurance during comprehensive imaging of the retina and anterior segment. Optometrists are involved in data entry into the Electronic Medical Record (EMR) system. The entire process requires prolonged sitting, sustained computer exposure, and repetitive extension of the left shoulder and upper arm for 5 to 15 minutes at a stretch to align the patient's head during imaging and operate the device.

In the Paediatric Outpatient Department, the optometrist conducts detailed eye assessments for children, including their history taking, acuity testing, ocular alignment checks, and Retinoscopy assessment—which requires repeated shoulder extension back flexion to adjust with patient's height.

In the department where Pre-Cataract Workup is the major objective known as Department of Biometry and Intraocular Lens (IOL) Clinic, Optometrists perform patient registration, take patient's ocular history, and perform digital biometry to record readings of keratometry and axial length for accurate intraocular lens power calculation. These tasks involve prolonged static sitting and continuous computer exposure for data verification, documentation, and uploading into the Electronic Medical Record (EMR) system.

In the department where the Laser-Assisted In Situ Keratomileusis (LASIK) workup process has been done, the optometrist conducts a comprehensive evaluation at pre-refractive surgery phase, this includes taking

detailed history, testing visual acuity, various types of refraction test, slit lamp examination, intraocular pressure measurement, advanced imaging (corneal topography/ tomography, pachymetry, aberrometry etc.) and tear film evaluation—before uploading results into the EMR system and further counselling.

Optometrist in the Glaucoma workup also involves in a comprehensive assessment, including detailed patient history taking, testing visual acuity, testing refraction, intraocular pressure measurement using Goldmann Applanation Tonometer, slit lamp examination, and gonioscopy to assess differentiation between open-angle and angle-closure glaucoma. After the evaluation, the optometrist counsels the patient, discusses management or referral steps, and records all findings in the Electronic Medical Records system.

Data Collection Tools and Techniques

Direct Observation

Work processes and working postures were observed during live clinical tasks. Observations included key variables like workstation setup, working postures, repetitive movements, tool use, and break patterns.

Videography

Videography of working postures were taken with proper consent to facilitate visual analysis of working posture alignment and body mechanics. Snapshots from the videos supported posture assessment scoring and documentation of workstation ergonomics.

Workstation Measurement

Assessment of workstation elements based on anthropometric data were taken which included seat height, reach distances, monitor level, desk depth, and leg clearance using measuring tape and anthropometric reference standards.

Assessment Instruments

Rapid Upper Limb Assessment (RULA)

Working postures were quantified using the Rapid Upper Limb Assessment (RULA) method developed by McAtamney and Corlett (1993), which assesses biomechanical and postural load on the upper limbs, neck, and trunk during task performance. RULA scores or action category were interpreted as follows:

- 1–2: Acceptable posture
- 3–4: Low risk; change may be needed
- 5–6: Medium risk; further investigation, change soon
- 7+: High risk; immediate change required

Nordic Musculoskeletal Questionnaire (NMQ)

The Nordic Musculoskeletal Questionnaire (Kuorinka *et al.*, 1987) was administered to assess self-reported musculoskeletal symptoms in nine body regions over three timeframes: the past 12 months, past 7 days, and at any time during their work. This helped determine prevalence and anatomical distribution of WMSDs.

Participant Interview and Feedback

Semi-structured verbal interactions were conducted with each optometrist during assessment day to collect contextual data about their workload, posture awareness, daily ergonomic challenges, and break pattern. Documentation of subjective discomfort and perceived strain areas was carried out and cross-referenced with objective assessments.

Ethical Considerations

The assessment was conducted in collaboration with the hospitals' management and clinical teams. Informed consent was obtained from each participant prior to documentation or photography.

Data Analysis

Department-wise and workstation-wise data were analysed to identify high-risk zones. The data collected from five departments were assessed using Microsoft Excel and SPSS statistical software version 22 (IBM statistics).

Results

The results of this study revealed a high prevalence of work related musculoskeletal disorders (WMSDs) among the participants. Most participant optometrists lacked formal ergonomic awareness; over 70% were unaware of correct posture standards. Reports concluded neck stiffness after 2–3 hours continuous work on slit lamp examination, and prevalent shoulder fatigue during retinal imaging.

Socio demographics & Workload

Mean age: 28 ± 5 years; average experience: 3 ± 2 years.

MSD Prevalence (NMQ)

The following table shows that prevalence of neck pain had the highest among participants, affecting 91.7% in the past twelve months and 75% in the past week before assessment.

Table 1. Prevalence of work related musculoskeletal disorders.

| Body Region | 12-month Prevalence (%) | 7-day Prevalence (%) |
|----------------|-------------------------|----------------------|
| Neck | 91.7 | 75 |
| Shoulder/Elbow | 41.7 | 29.2 |
| Lower Back | 33.3 | 25 |
| Wrist/Hand | 25 | 16.7 |
| Upper Back | 16.7 | 12.5 |
| Knee/Ankle | 8.3 | 4.2 |

Department-wise RULA Score Prevalence

- **OCT Department:** About 84% of working postures at RULA score 7.
- **Pediatric OPD:** 80% of working posture at RULA score 3–4; 20% ≥5.
- **Glaucoma Workup:** Over 89% of working postures at scores 3–6 in RULA
- **IOL:** About 71% of working postures at 4; about 10% ≥5.
- **LASIK:** 60% working posture scored 4-6 in RULA.

Time-in-Posture Metrics

- Neck flexion >20°: **45 ± 12 minutes/hour.**
- Left arm elevated above shoulder: **30 ± 10 minutes/hour.**

Discussion

This study result highlighted neck pain was the most commonly reported symptom, experienced by 91.7% of the participants, then shoulder and elbow pain were reported by 41.7% of respondents, lower back pain was noted in 33.3%, while wrist/hand discomfort affected 25%, discomfort in the upper back, thighs, knees, and ankles was comparatively lower ranging from 8.3%–16.7%. This result clearly indicate the high ergonomic risk faced by optometrists in high-volume eye care settings due to awkward postures, prolonged static sitting, poor workstation design, and lack of ergonomic training. Study results of postural assessments showed medium-to-high postural risk. The findings from the Standardised NMQ Questionnaire aligned closely with RULA scores, indicating a strong

association between perceived discomfort and objectively assessed ergonomic risk — prevalent in the neck, shoulders, and upper limbs areas, which are under constant strain during routine optometric tasks. Elevated RULA scores were directly associated with non-adjustable chairs and tables, fixed equipment positioning, inappropriate monitor height, prolonged shoulder elevation without support, manual tool adjustments and non-ergonomic patient positioning.

Study findings revealed high prevalence of musculoskeletal discomfort among optometrists which harmonizes closely with global evidence, in Australia, 82% of optometrists experienced work-related physical discomfort, most commonly in the neck, shoulders, and lower back (Long *et al.*, 2011), 61% of optometrists in Canada reported musculoskeletal pain in the past year (Diaconita *et al.*, 2019) and more than 75% of ophthalmologists suffered from MSDs, with 53% low back pain prevalence (Kaup *et al.*, 2020) and study in U.S., highlighted that two-thirds of ophthalmologists experienced upper back pain with neck pain (Schechet, 2020).

Conclusion

This study concluded a high prevalence of work-related musculoskeletal disorders (WMSDs) among optometrists at tertiary eye care hospital, Chennai, prevalent affected body parts are neck, shoulders, and back. Both objective (RULA) posture assessments and subjective (NMQ) questionnaire assessments confirm that awkward posture, repetitive movements, and suboptimal workstation design are key contributing factors. Immediate ergonomic interventions—such as height adjustable seating, monitor repositioning, and posture training may reduce biomechanical strain. Aligning with worldwide available literatures, these findings demand the urgent need for structured ergonomics awareness programs to safeguard the occupational health of optometrists.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Informed Consent Statement

All the optometrists included in the study provided written informed consent.

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