

ERGONOMICS IN OPHTHALMOLOGY PRACTICE: CROSS-SECTIONAL SURVEY AMONG PAKISTANI OPHTHALMOLOGISTS

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ABSTRACT

OBJECTIVE: To assess the ergonomic practices and prevalence of musculoskeletal symptoms among Pakistani ophthalmologists.

METHODS: This cross-sectional questionnaire-based study was conducted at College of Ophthalmology and Allied Vision Sciences/Eye Unit III (King Edward Medical University), Lahore, Pakistan from 01-03-2021 to 31-08-2021. A web-based close ended questionnaire (Google form) was developed consisting of questions related to posture in out-patient and operating room in addition to questions related to musculoskeletal symptoms, their effect on routine practice, management. Questionnaire was circulated via a social media application (WhatsApp) to ophthalmologists across Pakistan. Ophthalmologists at various levels of healthcare were included in study. One hundred and seven ophthalmologists consented to part of study and recorded their responses in questionnaire which were then evaluated.

RESULTS: Twenty (18.7%) of the participants were diagnosed as having musculoskeletal disorders. Lower back pain was the main symptom in 39 (36.4%) survey responders while 38 (35.5%) of them reported decreased clinical productivity owing to symptoms. Twenty-five (23.36%) participants had to modify their OPD activity owing to development of musculoskeletal symptoms ($p < 0.01$). Majority of those diagnosed with musculoskeletal symptoms adopted neutral spine postures (ergonomically safe) during work hours as compared to those who were not diagnosed with similar disease ($p > 0.05$). Participants who spent ≥ 6 hours in operation theater at a stretch were more prone to develop musculoskeletal symptoms ($p = 0.013$).

CONCLUSION: Majority of participants experienced musculoskeletal symptoms related to work necessitating the need for change in work place practices focusing on maintaining a neutral spine posture.

KEYWORDS: Ergonomics (MeSH); Ophthalmology (MeSH); Diagnostic Techniques, Ophthalmological (MeSH); Posture (MeSH); Patient Positioning (MeSH); Musculoskeletal Diseases (MeSH).

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INTRODUCTION

Hippocratic Oath is taken at the conclusion of "Bachelor in Medicine and Surgery" and before start of house job in Pakistan.¹ The crux of this oath is beneficence and to do no harm. However, those who pursue surgical sub-specialties as their career that harm may ensue from operating and working in clinical environment for longer hours and in a specific posture.²

Surgical sub-specialty residents are

mostly young who are usually trained in a fast paced and output driven environment where the issues of fatigue and burn out are generally looked down upon.^{3,4} Despite living in this era of technological advancement, operation theatres around the world and in particular Pakistan are not well designed and equipped ergonomically i.e. Irregular or no maintenance of equipment including surgical & outpatient machines and sitting chairs such that it inhibits one from attaining a

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neutral spine posture.

Thus the risk of musculoskeletal disorders increases in such population due to the fact that a static body position is maintained for long periods of time in out-door and operation theatre.⁵ These disorders or symptoms lead to decreased individual output of surgeons due to fact that they have to limit or modify their clinical practice in outdoor and operation theatre.⁶ Human factor ergonomics is scientific domain which entails interaction between human resource and different components of a system with the application of data, methods and principles so as to optimize personal wellbeing and increased output.^{7,8}

Ophthalmologists are more prone to develop musculoskeletal disorders due to the nature of clinical work. They have to sit in a static body posture in outpatient and in operation theatre as well. If the standard ergonomic practices are not incorporated in routine clinical practice, it may lead to arthritic and muscular symptoms eventually leading to decrease in clinical and surgical activity.

Ergonomic practices among ophthalmologists have been studied in various countries across the globe but never in Pakistan. This phenomenon assumes more importance due to the fact that public sector hospitals are almost always in need of support and funds from the government but this need is not always met. This leads to wearing of equipment and machines which may add to poor ergonomic practices of ophthalmologists leading to

decreased work output and musculoskeletal symptoms. The objective of this study was to assess ergonomic practices in Pakistani ophthalmologists and their impact in terms of developing musculoskeletal symptoms.

METHODS

This cross-sectional questionnaire based study was conducted after ethical approval at College of Ophthalmology and Allied Vision Sciences/Eye Unit III (King Edward Medical University), Lahore from 01-03-2021 to 31-08-2021. A web-based close ended questionnaire (Google form) was developed consisting of questions related to posture in out-patient and operating room in addition to questions related to musculoskeletal symptoms, their effect on routine practice, management, body mass index etc. The questionnaire was circulated via a social media application (WhatsApp) to ophthalmologists across Pakistan. Ophthalmologists at various levels of healthcare were included in study.

Data analysis was done on SPSS version 22. Responses to questions are mainly presented as percentages. Chi square test was applied to check for significance of responses while Kruskal-Wallis test was applied to check for significance of ergonomic practices in study population having musculoskeletal symptoms. Cronbach-Alpha test was used to check for reliability of responses.

RESULTS

One hundred and seven ophthalmologists consented to be part of study and recorded their responses in questionnaire which were then evaluated. Majority (n=76, 71%) of participants were from 25-35 year's age group i.e. residents or young consultants with a male predominance belonging to public sector hospitals. Body mass index of sixty-one (57%) participants was within normal limits while twenty (18.7%) were known cases of any arthritic condition. Eighty (74.8%) participants had experienced musculoskeletal symptoms most common of which was lower back pain in thirty-nine (36.4%) individuals

TABLE I: DEMOGRAPHICS, MUSCULOSKELETAL DISORDERS, AVAILABILITY OF ERGONOMIST AND AWARENESS ABOUT ERGONOMIC PRACTICES

Variables		* Number (%)	*P-value
Age (years) (n=107)	25-35	76 (71)	<0.001
	36-45	17 (15.9)	
	46-55	08 (7.5)	
	56-65	06 (5.6)	
Gender (n=107)	Male	58 (54.2)	<0.001
	Female	49 (45.8)	
Sector of Work (n=107)	Public Sector	78 (72.9)	<0.001
	Private Sector	17 (15.9)	
	Public and Private	09 (8.4)	
	Prefer not to say	03 (2.8)	
Body mass index falls within the normal range (n=107)	Yes	61 (57.0)	<0.001
	No	32 (29.9)	
	May be	14 (13.1)	
Have you ever been diagnosed with an arthritic condition? (n=105)	Yes	20 (18.7)	<0.001
	No	85 (79.4)	
Nature of Musculoskeletal Disorders (n=80)	Low back pain	39 (36.4)	<0.001
	Neck pain	24 (22.4)	
	Upper extremity pain/ wrist pain	07 (6.5)	
	Knee pain	02 (1.9)	
	Small joint of upper & lower limb	06 (5.5)	
	None	02 (1.9)	
Duration of Musculoskeletal Disorders experienced (n=80)	More than 24 months	16 (15.0)	<0.001
	Less than 6 months	41 (38.3)	
	6 months to <12 months	16 (15.0)	
	12 months to <24 months	07 (6.5)	
Duration of episodes of pain experienced in the past year (n=88)	Pain lasted for weeks	09 (8.4)	<0.001
	Pain lasted for months	06 (5.6)	
	Pain lasted for hours	17 (15.9)	
	Pain lasted for days	15 (14.0)	
	Occasional	37 (34.6)	
	Constant	04 (3.7)	
Treatment taken for Musculoskeletal Disorders (n=84)	Physiotherapy	10 (9.3)	<0.001
	Supplements & other medication	55 (51.4)	
	Both	19 (17.7)	
Limitation of clinical work secondary to Musculoskeletal Disorders (Productivity Loss) (n=93)	Yes, slightly	38 (35.5)	<0.001
	Yes, severely	03 (2.8)	
	Yes, moderately	09 (8.4)	
	No	43 (40.2)	
Have you read literature/ attended talks or seminars on ergonomics in ophthalmology? (n=107)	Yes	10 (9.3)	<0.001
	No	97 (90.7)	
Services of an ergonomist / expert in occupational safety at workplace (n=107)	Yes	06 (5.6)	<0.001
	No	101 (94.4)	
Recommend a seminar/talk on ergonomics in ophthalmology to spread awareness (n=107)	Yes	105 (98.1)	<0.001
	No	02 (1.9)	

TABLE I: CLINICAL WORK ERGONOMIC DYNAMICS (WORK HOURS, POSTURE)

Variables (n=107*)		Participants having MSD (n=60)	Participants without MSD (n=30)	Participants not sure about MSD (n=17)	*P-value (Kruskal-Wallis Test)
Sitting hours per day during OPD	>8 hours (n=15)	13 (12.14%)	01 (0.93%)	01 (0.93%)	0.255
	5-8 hours (n=67)	34 (31.77%)	22 (20.56%)	11 (10.28%)	
	2-4 hours (n=22)	13 (12.14%)	06 (5.60%)	03 (2.80%)	
	<2 hours (n=3)	-----	01 (0.93%)	02 (0.93%)	
Modifying OPD working techniques to reduce injury / pain	*Yes (n=36)	25 (23.36%)	11 (10.28%)	-----	0.006
	*No (n=54)	35 (32.71%)	19 (17.75%)	-----	
Taking small breaks from your work every 30 minute	Yes Always (n=5)	04 (3.73%)	01 (0.93%)	-----	0.907
	Sometimes(n=42)	22 (20.56%)	13 (12.14%)	07 (6.54%)	
	No (n=60)	34 (31.77%)	16 (14.95%)	10 (9.34%)	
Doing stretch exercises during micro breaks between patients?	Yes Always (n=6)	05 (4.67%)	01 (0.93%)	-----	0.144
	Sometimes (n=25)	16 (14.95%)	07 (6.54%)	02 (1.86%)	
	No (n=76)	39 (36.44%)	22 (20.56%)	15 (14.01%)	
Using a well-designed chair with back and neck rest?	Yes Always (n=6)	05 (4.67%)	01 (0.93%)	-----	0.044
	Sometimes(n=17)	13 (12.14%)	03 (2.80%)	01 (0.93%)	
	No(n=84)	42 (39.25%)	26 (24.29%)	16 (14.95%)	
Maintaining safe posture while examining patients? (Head neck-torso aligned vertically in a neutral posture without neck pushed forward or head tilted down or up)	Yes Always(n=52)	33 (30.84%)	13 (12.14%)	06 (5.60%)	0.305
	Sometimes (n=11)	04 (3.73%)	06 (5.60%)	01 (0.93%)	
	No (n=44)	23 (21.49%)	11 (10.28%)	10 (9.34%)	
Time spent operating/ doing lasers per week?	>10 hours (n=17)	12 (11.21%)	04 (3.73%)	01 (0.93%)	0.480
	6-10 hours (n=24)	13 (12.14%)	08 (7.47%)	03 (2.80%)	
	2-5 hours (n=34)	19 (17.75%)	10 (9.34%)	05 (4.67%)	
	<2 hours (n=32)	16 (14.95%)	08 (7.47%)	08 (7.47%)	
At a stretch, Time spent in operating?	6-10 hours (n=5)	04 (3.73%)	01 (0.93%)	-----	0.013
	3-5 hours (n=27)	21 (19.62%)	05 (4.67%)	01 (0.93%)	
	1-2 hours (n=55)	25 (23.36%)	20 (18.69%)	10 (9.34%)	
	<1 hour (n=20)	10 (9.34%)	04 (3.73%)	06 (5.60%)	
Participants who adjust table / equipment height/ seat before starting the surgery	Yes Always (n=18)	08 (7.47%)	05 (4.67%)	05 (4.67%)	0.431
	Sometimes (n=82)	49 (45.79%)	22 (20.56%)	11 (10.28%)	
	No (n=7)	03 (2.80%)	03 (2.80%)	01 (0.93%)	
Maintaining neutral spine while operating by [Keeping knees bent at 90 degree]	Yes (n=64)	40 (37.38%)	17 (15.88%)	07 (6.54%)	0.156
	No (n=43)	20 (18.69%)	13 (12.14%)	10 (9.34%)	
Maintaining neutral spine while operating by [Feet flat on floor]	Yes (n=55)	29 (27.10%)	18 (16.82%)	08 (7.47%)	0.540
	No (n=52)	31 (28.97%)	12 (11.21%)	09 (8.41%)	
Maintaining neutral spine while operating by [Thighs parallel to floor]	Yes (n=67)	38 (35.51%)	21 (19.62%)	08 (7.47%)	0.294
	No (n=40)	22 (20.56%)	09 (8.41%)	09 (8.41%)	
Maintaining neutral spine while operating by [Back Straight]	Yes (n=59)	31 (28.97%)	18 (16.82%)	10 (9.34%)	0.717
	No (n=48)	29 (27.10%)	12 (11.21%)	07 (6.54%)	

*Number of responses received varied for different variables

followed by neck pain in twenty-four (22.4%) individuals (Table I). Fifty (46.7%) participants felt that they have to limit their clinical work due to these symptoms. Study participants ranged from varying ophthalmology sub specialties i.e. medical and surgical retina, pediatric ophthalmology, glaucoma, oculoplastics and general ophthalmology.

Twenty-five (23.36%) of overall participants had to modify their OPD activity owing to development of musculoskeletal symptoms ($p=0.006$). Participants who spent 6 or more hours in operation theatre at a stretch were more prone to develop musculoskeletal symptoms ($p=0.013$) [Table II].

Reliability of responses were measured by applying Cronbach-Alpha test showing Cronbach's Alpha of 0.614 and Cronbach's Alpha Based on Standardized Items as 0.579 while K (number of items) was 25.

DISCUSSION

Our study was a questionnaire based survey related to the ergonomic practices of ophthalmologists. Thirty-four (31.77%) of participants, who later developed MSD symptoms had to sit for 5-8 hours in outpatient while only one (0.93%) of the participants, who did not have MSD had access to chairs with back and neck rest. Majority of participants in both MSD, nineteen (17.75%) and not MSD, ten (9.34%) spent more than 5 hours weekly in applying lasers. Majority of participants having MSD maintained neutral spine posture while working contrary to participants without MSD in which only 17-21% did maintain neutral spine posture at work. Diaconita V and associates⁹ developed a web based survey and obtained responses of ophthalmologists and optometrists in practice. Hundred and twenty one ophthalmologists and optometrists voluntarily completed the survey. Almost 48% ophthalmologists experienced musculoskeletal pain in past one year which they owed to their operation theatre routine. About 22.4%

reported neck pain and 36.4% had back pain among them. A similar survey was conducted by Schechet SA and colleagues¹⁰ in United States of America. Their study also showed almost similar results in which the ophthalmologists were of the opinion that operation theatre routine is responsible for their musculoskeletal disorder symptoms. Out of 127 participants, 85 experienced job related pain in body. Above studies results are similar to our study results in which 26.96% of participants who developed musculoskeletal symptoms owed it to operating hours and performing lasers for more than five hours daily.

Shaw C et al¹¹ conducted a study to check if vitreoretinal surgeons were more prone to get musculoskeletal disorders. It was noted that vitreoretinal surgeons have a greater degree of neck and spinal cord flexion while doing indirect ophthalmoscopy as compared to slit lamp examination ($p\leq 0.01$). They concluded that vitreoretinal surgeons are more susceptible to develop musculoskeletal disorders and this conclusion is in line with our study results in which participants having MSD spent 5-8 hours at a stretch in outpatient and 6-10 hours weekly doing lasers. Venkatesh R and associates¹² assessed the prevalence and severity of spinal pain in practicing ophthalmologists of India. About 53.1% of ophthalmologists were cataract surgeons and the rest were general ophthalmologists. About 49% of research participants had lower spine pain as compared to 36.4% in our study, similarly 33% experienced neck pain while in our study 22.4% experienced so. According to survey, performing indirect ophthalmoscopy and retinal lasers were associated with the above symptoms in most of the participants.

Al-Juhani MA and colleagues¹³ studied factors associated with musculoskeletal disorders among ophthalmologists in Saudi Arabia. In this cross sectional study, number of years in service, mental stress and comorbidities were not associated

with neck or back pain. Instead, work related discomfort in posture was related to musculoskeletal symptoms in neck and back. Hyer JN et al¹⁴ did a cross sectional survey of ophthalmologist in the United Kingdom about neck and spine pain. 515 of the participants reported back and neck pain during their working hours. Thirty-three percent of them experienced pain in the operation theatre. Of those 33%, 78% reported that performing ophthalmic surgery increased their musculoskeletal pain.

Kherani F and associates¹⁵ assessed ergonomics in ophthalmologists and allied eye care professionals by conducting a survey. In their study, 61.2% of participants reported that they felt musculoskeletal symptoms while using electronic medical records posing as a challenge to routine ophthalmic service. Another study conducted in India in which researchers studied ergonomic practices among ophthalmologists. Results showed 52.9% of the respondents reported lower spine pain as the frequent symptom which were commonly associated with operation room ergonomic practices.¹⁶

In a review article, Honavar SG¹⁷ discussed the factors associated with improper work related ergonomics and its implications on quality of life and ophthalmic practice. Commonly reported symptoms in this article are neck and back pain, numbness in fingers and toes and carpal tunnel syndrome. The symptoms described by Honavar SG are similar to our results i.e. lower back and neck pain. He further added that inadequate workplace ergonomic practice leads to early disability and retirement from work. Sivak-Callcott JA et al¹⁸ focused on ophthalmic plastic and reconstructive surgery and studied ergonomics in this sub specialty. In their questionnaire based survey, 72.5% respondents reported neck of spine pain related to working in operating room, a minority of whom had to stop operating due to the symptoms.

Chams H et al¹⁹ asked about varying occupation related entities from

Iranian ophthalmologists with the help of a questionnaire. Most common encountered problem was infectious conjunctivitis (49.4%) followed by contact dermatitis and back pain (43.2%). Dhimitri KC and associates²⁰ described the musculoskeletal disorders of neck, back and upper extremities in ophthalmologists. Their survey showed 51% self-reported prevalence of back and neck symptoms limiting the clinical work of 15% of survey participants.

Limitation of this study was being a survey based study. Authors recommend a qualitative study on this subject to get concrete recommendations.

CONCLUSION

Poor ergonomic practices lead to development of musculoskeletal symptoms and limitations in work. Good Ergonomic practices in ophthalmology are of vital importance considering nature of clinical and surgical work.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

AR: Conception & study design, acquisition of data, drafting the manuscript, approval of the final version to be published

MS: Acquisition of data, critical review, approval of the final version to be published

UR: Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

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The data that support the findings of this study are available from the corresponding author upon reasonable request



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