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Effects of Ergonomics Among Ophthalmologists on Pain and Function - An Interventional Study

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ABSTRACT

Background and objectives: Work-related musculoskeletal disorders (WRMSDs) are musculoskeletal problems that are generally caused in the workspace and may lead to diverse disorders affecting different parts of the musculoskeletal system. Body posture and movement, environmental factors, information and operation, and work organization are all factors that play a role in ergonomics. Hence, the effects of ergonomics on musculoskeletal pain and function among Ophthalmologists were studied.

Method: This study consisted of two phases, phase 1 was the screening phase and phase 2 was the intervention phase. The screening was done by a Nordic pain questionnaire and workplace ergonomic risk assessment (WERA). A total of 60 ophthalmologists were included in the intervention phase; they were randomly divided into two groups: The interventional group (ergonomic advice given) and the control group (ergonomic advice not given). Pre-intervention data and post-intervention data were taken for pain and function by numeric pain rating scale and patient-specific functional scale respectively. Post-intervention data were collected after 6 weeks.

Result: Within-group analysis of the interventional group and between-group analysis showed a significant difference indicating that there was a statistically significant reduction in the pain ($p<0.05$) and improvement in function ($p<0.05$) whereas within-group analysis of the control group did not show a significant difference.

Conclusion: Ergonomics is an effective measure for reducing pain and improving function among ophthalmologists.

Keywords: Ergonomics, Function, Pain, Ophthalmologists, Pain, Work-related musculoskeletal disorders, WRMSDs.

INTRODUCTION

Musculoskeletal disorders, often known as MSDs, are inflammatory and degenerative diseases that produce discomfort and have a detrimental impact on daily activities as usual. Workplace-related musculoskeletal disorders (WRMSDs) are musculoskeletal issues that are typically brought on by the workplace and can result in a variety of disorders that impact various musculoskeletal system components. MSDs can happen from sudden effort, performing the same activities repeatedly, or through repetitive stresses, vibrations, or awkward postures.[1] The clinical practice of ophthalmology largely requires repetitive tasks requiring fine motor control and close attention, which can increase tension in the head, neck, and upper limbs. Long periods spent in awkward positions can also contribute.[2] Ophthalmologists frequently have debilitating neck pain, numbness in the hands and legs, carpal tunnel syndrome, and debilitating back pain. When doing routine tasks like a slit lamp examination, using an indirect ophthalmoscope, or even sitting in a surgeon's chair, most work-related problems

among ophthalmologists are brought on.[3] [4] By enhancing safety, well-being, and comfort, ergonomics can enhance human welfare. Most designs are originally suitable for only 95% of the population due to demographic heterogeneity. This indicates that 5% of users, who require specific, particular ergonomic measures, would not be accommodated by the design.[5] Research has revealed that awkward postures and prolonged work periods among ophthalmologists cause various musculoskeletal disorders. This study was conducted to determine the impact of ergonomics among ophthalmologists on pain and function.

MATERIALS AND METHOD

TOTAL STUDY DURATION: Six weeks

SAMPLE SIZE: 30 in each group i.e., intervention and control group.

SAMPLE SIZE CALCULATION: The statistical number 30 was taken for the sample size since there was not enough literature as a reference to calculate the optimal sample size. A sample size of 30 is taken as a cut-off normally. A sample size less than that is considered biased and should not be relied upon for concluding.[6]

SAMPLING METHOD: Simple Random Sampling.

STUDY DESIGN: An interventional study

SOURCE OF THE DATA COLLECTION: Ophthalmologists in Ahmedabad

SELECTION CRITERIA:

INCLUSION CRITERIA

- Willingness to participate.
- Practicing Ophthalmologists.
- NPRS score 4-6.
- Both male and female.
- Working hours per day: >4.
- Age: < 65 Years.

EXCLUSION CRITERIA

- Any orthopedic disorders, neurological disorders, or surgical history.
- Individuals taking painkillers.

WITHDRAWAL CRITERIA

- If pain aggravates.
- Participant wishes to discontinue.

STUDY PROCEDURE

After taking informed written consent from the subject, demographic data was collected.

Phase 1 was the screening phase, as per inclusion and exclusion criteria, screening of ophthalmologists was done by Nordic Musculoskeletal Questionnaire and Workplace Ergonomic Risk Assessment.[7][8][9]

Phase 2 was the intervention phase; participants were divided into intervention groups and control groups randomly.

The intervention group was advised on the application of ergonomics which was tailor-made from the SOP of the ergonomic advice, while the control group was not given any advice.

Pre-intervention pain and function assessment was done by Numeric Pain Rating Scale and Patient Specific Functional Scale respectively.[10][11]

The Ophthalmologists in the Intervention group- Group A were asked to maintain an exercise diary. Telephonic and in-person follow-ups were taken once a week.

After 6 weeks, post-intervention pain and function assessment was done and the results were analyzed.

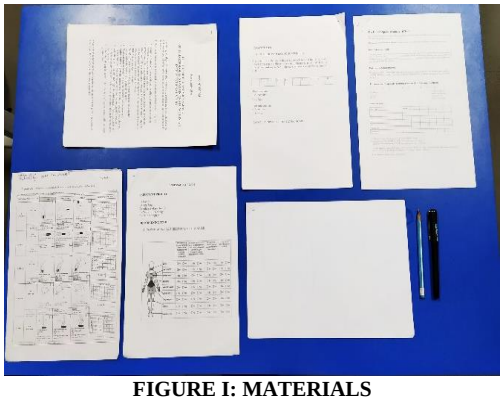


FIGURE I: MATERIALS

FIGURE II: INDIRECT OPHTHALMOSCOPY- PRE-INTERVENTION

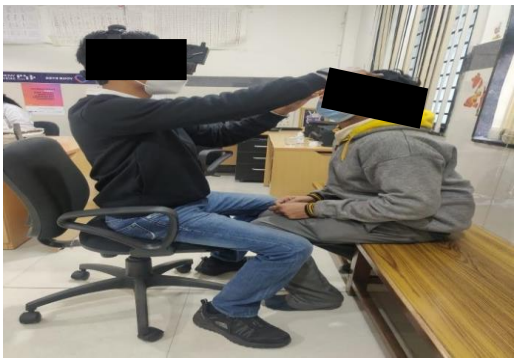
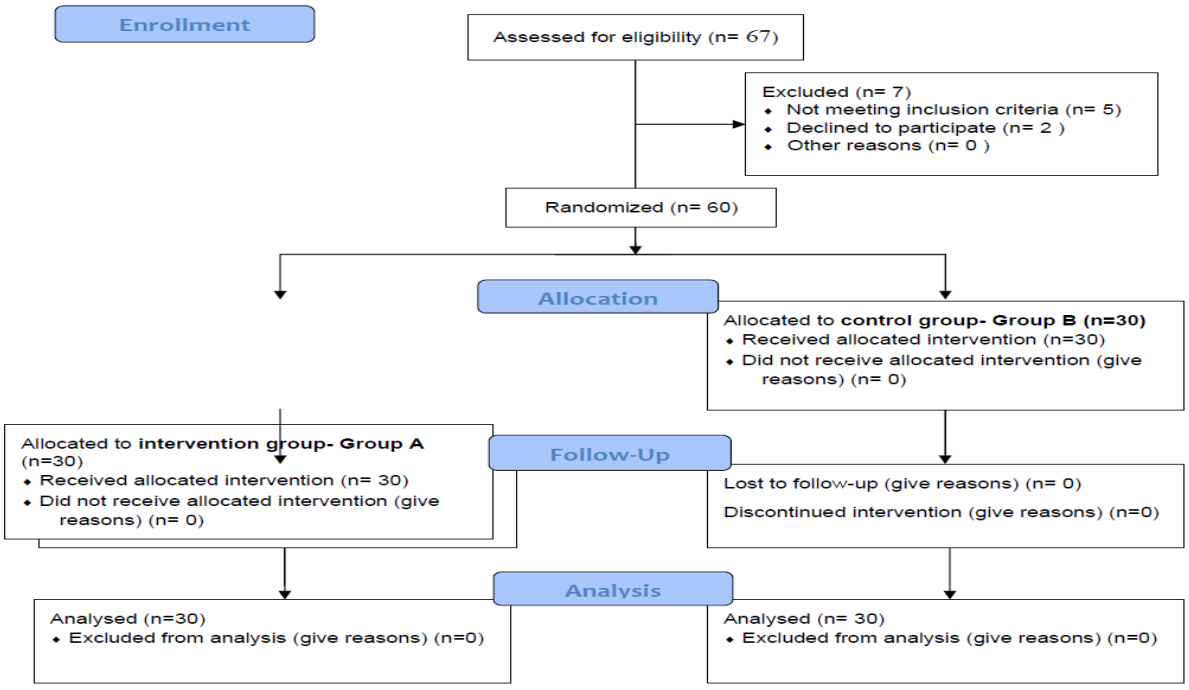


FIGURE III: INDIRECT OPHTHALMOSCOPY- POST-INTERVENTION

FIGURE IV: SLIT LAMP EXAMINATION - PRE-INTERVENTION

FIGURE V: SLIT LAMP EXAMINATION - POST-INTERVENTION

CONSORT 2010 Flow Diagram



STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 28. Before analysis, normal distribution and baseline differences were screened. within-group analysis was done using baseline outcome measures taken before and after 6 weeks. The level of significance was 5% with a confidence interval of 95%. To check whether the data follows normal distribution or not, Kolmogorov-Smirnov and Shapiro-Wilk were applied.

Within-group analysis

Interventional group:

To analyze the differences in the NPRS and PSFS after 6 weeks of intervention in interventional, paired t-test was used as data was normally distributed.

Control group:

To analyze the differences in the NPRS and PSFS after 6 weeks in the control group, paired t-test was used as data was normally distributed.

Between-group analysis:

For between-group analysis of both the outcome measures unpaired t-test was used as the data was normally distributed. The p-value was <0.05 for NPRS and PSFS.

RESULTS

Table I: The mean age of participants in both groups

Group	No. of subjects	Age (years) Mean±SD
Group A	30	35.26±10.8
Group B	30	34.1±10.88

Table II: Gender distribution of participants in both groups

Group	No. of Male	No. of Female	Total
Group A	11 (36.66%)	19 (63.33%)	30
Group B	12 (60%)	18(40%)	30

Table III: Baseline Characteristics

Variable	Group A (Mean±SD)	Group B (Mean±SD)	Z Value	P Value (<0.05)
Age	35.26±10.8	34.1±10.88	0.83	0.40
Gender	15±5.65	15±4.24	0.07	0.79
NPRS	5.04±0.84	4.96±0.78	0.28	0.77
Patient-Specific Functional Scale	5.92±1.53	5.72±1.47	0.22	0.81

Within-group analysis:

Intervention group- Group A:

Analysis showed a significant statistical difference in NPRS and PSFS values within a group ($p<0.05$).

Table IV: Intervention group- Group A NPRS Pre-Post Difference

Group	Pre- Intervention Mean±SD	Post-intervention Mean±SD	t-value	P value (<0.05)
GROUP A	5.03±0.85	1.73±1.11	12.91	0.00001

Table V: Intervention group- Group A Patient Specific Functional Scale Pre-Post Difference

Group	Pre-Intervention Mean±SD	Post-intervention Mean±SD	t-value	P value (<0.05)
GROUP A	5.99±1.43	8.63±1.04	-8.15	0.00001

Control group- Group B:

Analysis showed no significant statistical difference in NPRS and PSFS values within a group ($p>0.05$).

Table VI: Control group -Group B NPRS Pre-Post Difference

Group	Pre Mean±SD	Post Mean±SD	t-value	P value (<0.05)
GROUP B	4.96±0.80	4.93±0.73	0.16	0.86

Table VII: Control group -Group B Patient Specific Functional Scale Pre-Post Difference

Group	Pre Mean±SD	Post Mean±SD	t-value	P value (<0.05)
GROUP B	5.89±1.46	5.79±1.43	0.26	0.79

Between-group analysis:

The p-value was <0.05 for NPRS and PSFS, which showed a significant statistical difference.

Table VIII: Between Group Comparison Of NPRS

Variable	Intervention Group-Group A Mean±SD	Control Group-Group B Mean±SD	t-value	p-value (<0.05)
NPRS	1.73±1.11	4.93±0.73	-12.41	0.00001

Table XI: Between Group Analysis of Patient-Specific Functional Scale

Variable	Intervention Group – Group A Mean±SD	Control Group-Group B Mean±SD	t-value	p-value (<0.05)
Patient-Specific Functional Scale	8.63±1.04	5.79±1.43	8.78	0.00001

DISCUSSION

Musculoskeletal diseases are conditions that affect the muscles, nerves, tendons, ligaments, joints, cartilage, and spinal discs that are brought on by physically strenuous activities and environments at work. Examples of musculoskeletal problems include low-back strain, carpal tunnel syndrome, tendinitis, sciatica, and ruptured spinal discs. Furthermore, the inability to adapt the task to the individual's ability might lead to musculoskeletal disorders.

According to two surveys done for the prevalence of WRMSDs among ophthalmologists, it was found that back pain was the most common problem among ophthalmologists followed by neck pain, and some reported upper extremity pain as well followed by lower extremity pain.[12][13]

To prevent WMSDs at work, ergonomics-which is defined as the science of matching individuals to their jobs-seeks out workable solutions. With the ultimate goal of increasing productivity, enhancing satisfaction, and lowering accidents and illnesses, ergonomics aims to design workplaces, workstations, facilities, furniture, equipment, tools, and job duties that are compatible with human dimensions, capabilities, and expectations.[14]

The present study was conducted to see the effect of ergonomics among ophthalmologists on pain and function. This was an interventional study conducted on 60 ophthalmologists in Ahmedabad. Participants were divided into 2 groups. Group A was the interventional group and Group B was the control group. All the participants of group A were advised in following the ergonomic protocol which was tailor-made from the SOP of ergonomics created whereas participants in group B were not given any advice.

The present study hence shows ergonomics improves pain and function among ophthalmologists. Whatever reduction occurred in group B could be reported as a reduction in the workload, or taking the rest due to pain.

There are very few studies about know the effects of ergonomics among ophthalmologists. In one study where the efficacy of teaching ergonomics for the slit lamp examination was evaluated among 10 Ophthalmology residents, they were educated about the proper ergonomics for the slit lamp examination, Data were processed using biomechanical software to obtain the Rapid Upper Limb Assessment (RULA) injury risk score, elbow and shoulder joint reaction moments, neck and trunk flexion angles, and spinal curvature magnitudes, after two weeks the trail process was repeated which showed decreased risk score for RULA, decreased Shoulder flexion and elbow abduction moments suggesting a more neutral body posture, and more neutral spinal posture,

suggest a promising ability for an educational module to mitigate some injury risk in this population during indirect slit lamp examination.[15] This study suggests that implementing proper ergonomics is essential.

In one study, where they observed whether the exposure to the mechanical load leads to the WRMSDs, they divided 16 ophthalmologists into 2 groups one with a surgical session and another with a control session, pre-screening for any pain or tissue texture abnormality was done, 5 participants in the surgical session had an increase in the level pain and tissue texture abnormality and 3 had no change in pain or tissue texture abnormality, whereas 5 participants in the control group had a decrease in the level of pain and tissue texture abnormality and 3 had an increase in pain and tissue texture abnormality. The increase in the pain and tissue texture abnormality was attributed to the choice of activity the participants choose to do during the control session.[13]

The limitations of this study were smaller sample size, and follow-up daily to check whether the participants followed the ergonomics or not was taken.

CONCLUSION

From the current study, it can be concluded that ergonomics is an effective measure for reducing pain and improving function among ophthalmologists.

Clinical implication: Ergonomics should be included in the daily practice for eliminating and reducing the occurrence of WRMSDs among Ophthalmologists.

Conflict of interest: There was no conflict of interest in conducting this study.

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