



Ergonomic Risk Assessment In Clinical Laboratory Technicians

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ABSTRACT

Background -A clinical laboratory technician working under microscope requires static posture of the spine and upper extremity for long period of time. This makes them prone to develop musculoskeletal disorders. Occupations which require maintaining static postures for long hours put increase load or forces on the muscles and tendons which lead to fatigue and pain. Apart from reducing the workers' quality of life and productivity, WMSDs are the most expensive form of work disability. Thus, the primary aim of the study was to assess Ergonomic risk in clinical laboratory technicians.

Method-. Study was done on 35 microbiologists working in Kasturba hospital, Mumbai and in some private clinics. A self-made questionnaire and RULA tool was used to assess the ergonomic risk factors.

Results-19 subjects have a RULA score of 3, 9 subjects have a RULA score of 4, 4 subjects have a RULA score of 5, 3 subjects have a RULA score of 6. None of the subjects have score between 1 &2 and score 7 and above (Graph.3).80% of the subjects lie in action level 2, 20% of the subjects lie in action level 3, none of them lie in action level 1 & 4.

Conclusion-Physical ergonomic risk is mild to moderate in clinical laboratory technicians, demanding early changes in posture and further investigation. Neck pain and forearm support during work were attributed as risk factors for increase in RULA score.

Keywords- Laboratory Technician, ergonomic Risk, Pain, Musculoskeletal disorders, RULA

INTRODUCTION

Musculoskeletal disorders (MSDs) are faced by everyone in our lives. Most of the musculoskeletal pain is occupation related. Occupation related MSDs have evolved due to long working hours, faulty postures, repetitive activities and maintaining static

postures for long periods of time (1, 2). The association of prolonged use of microscope with chronic syndromes have been recognized. (3, 4). The prevalence of work related musculoskeletal disorders (WRMSDs) is high in occupations which involve constant postures for long hours, excessive use of specific movements, lack of corrective measures taken etc. like IT professionals, call center jobs, laboratory technicians, watch repairers, Tailors and many more. Of these, microscope users show high prevalence of neck pain, shoulder pain, elbow pain and hand pain. (17, 3)

A clinical laboratory technician working under microscope requires static posture of the spine and upper extremity for long period of time. This makes them prone to develop musculoskeletal disorders. A clinical laboratory technician is a person who studies microscopic life. Their main aim is to identify the causative micro-organism and give the probable diagnosis. By nature, work with microscope demands precision and the ability to concentrate over long periods of time. Looking through a microscope requires keeping the head in the same exact position for long period (5). This type of posture especially strains the neck muscles. It often requires forward or side abduction movements of the upper extremities in order for the adjustment knobs to be used.(5) Such kind of occupations which require maintaining static postures for long hours put increase load or forces on the muscles and tendons which lead to fatigue and pain(6). Thus maintaining flexed positions of neck, shoulders and lower back for longer period of time can make them prone to develop faulty posture and relative MSDs. This in turn causes worker inability, expense raise and efficacy reduction. In many studies of the prevalence of different musculoskeletal pains, it was reported as more than 50% (7-9) of the MSDs were due to, poor posture of upper-limb [10, 11], repetitive movements and long-term static contractions [12].

Poor postures leads to muscle imbalance and reduced strength of the muscles (14). This muscle imbalance gives rise to development of forward head posture, rounded shoulders, pain, restricted range of motion, stiffness etc. Thus maintaining such postures over a prolonged period of time make them prone to develop musculoskeletal disorders. Work-related musculoskeletal disorders (WMSDs) are responsible for morbidity in many working populations. Apart from reducing the workers' quality of life and productivity, WMSDs are the most expensive form of work disability. Although health care profession is known to be at a high risk for WMSDs, it is one of the least-studied occupations. Most of the previous studies on WMSDs among health care workers were limited to any one of the professional groups such as nurses, physical therapists, dentists, and others (18). Very few researches have been done on laboratory technicians who are constantly under the influence of microscope.

Therefore there arise a need to identify ergonomic risk and factors that are responsible for MSD's which will in long term may develop serious health hazards. Thus, the primary aim of the study was to assess Ergonomic risk in clinical laboratory technicians. The objectives of the study were to assess the ergonomic risk in clinical laboratory

technicians and to identify factors responsible for ergonomic risk in clinical laboratory technicians (microscope users).

MATERIALS AND METHODS

Study design and participants

Institutional ethics committee approval was taken before starting the study. Study was done on 35 microbiologists working in Kasturba hospital, Mumbai and in some private clinics. A self-made questionnaire and RULA tool was used to assess the ergonomic risk factors. Also postural analysis was done on observation. Subjects with minimum 2 years of experience were included and those with less than 2 years of experience and past neck trauma were excluded. Both males and females were included in the study. A consent was taken from each one of them before beginning the research. The subjects were distributed the questionnaire. They were instructed about how to and what to fill in the questionnaire & explained the motive behind the study. The subjects were asked to fill the appropriate details applicable to each one of them. Later they were asked to continue their work and RULA scale was scored for each of them. Statistical analysis: Descriptive statistics was used. Cross tabulation was done and chi square test was performed. Spearman's correlation was used for association between relevant factors and RULA score using SPSS 16.

OUTCOME MEASURE

Rapid Upper Limb Assessment Tool

The RULA Assessment Tool was developed to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity MSD. The RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities. Based on the evaluations, scores are entered for each body region in section A for the arm and wrist, and section B for the neck and trunk. After the data for each region is collected and scored, tables on the form are then used to compile the risk factor variables, generating a single score that represents the level of MSD risk. Scores of 1-2 indicate negligible risk, 3-4-low risk, 5-6-medium risk and scores of 7 and above indicate high risk (13)

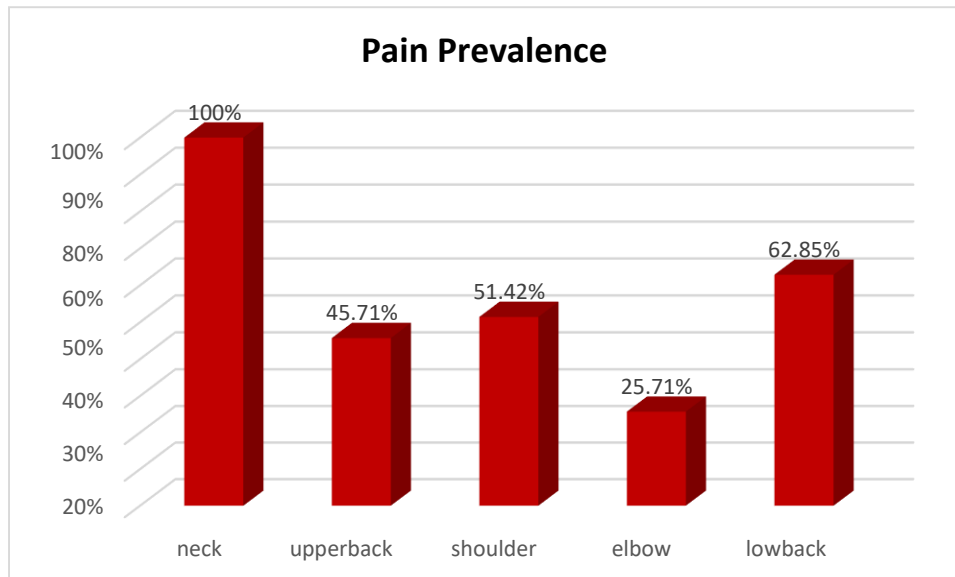
RESULTS

Table 1. Demographic and work details of microbiologists

	Mean±SD
AGE	Females45.14±9.87
	Males46.12 ± 7.03
Mean years of experience	14.11 ± 7.34

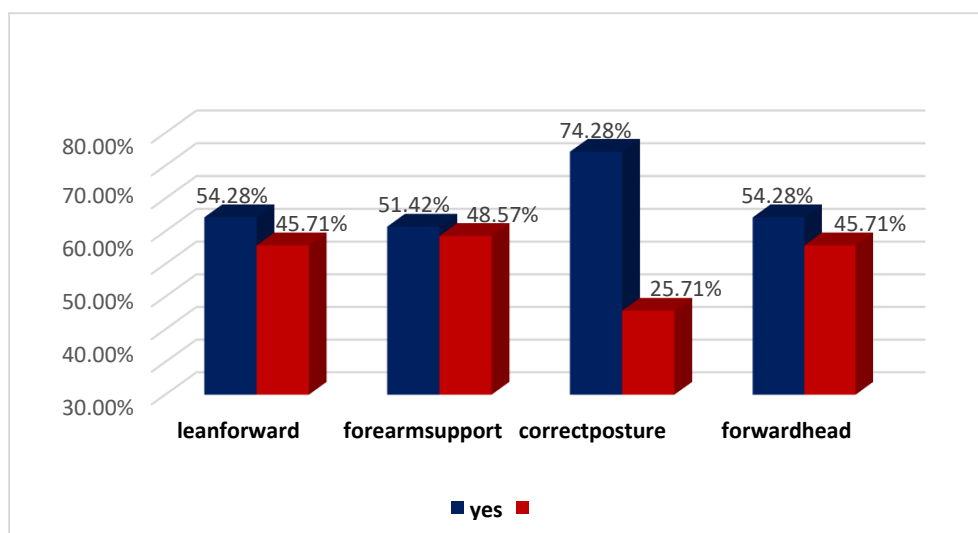
Microscope work at stretch (mins)	27.05 ± 19.14
Breaktime (mins)	9.86 ± 9.23

GRAPH 1: PAIN PREVALENCE IN CLINICAL LABORATORY TECHNICIANS



Pain Areas	Neck	Upper Back	Shoulder	Elbow	Low Back
Prevalence	100%	45.71%	51.42%	25.71%	62.85%

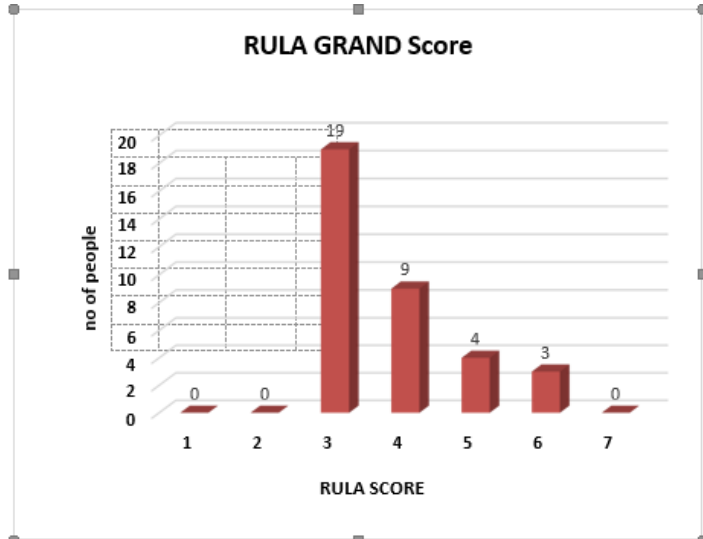
GRAPH 2: RELEVANT ERGONOMIC FINDINGS IN CLINICAL LABORATORY TECHNICIANS



Factors	Yes	No
Lean Forward	54.28%	45.71%

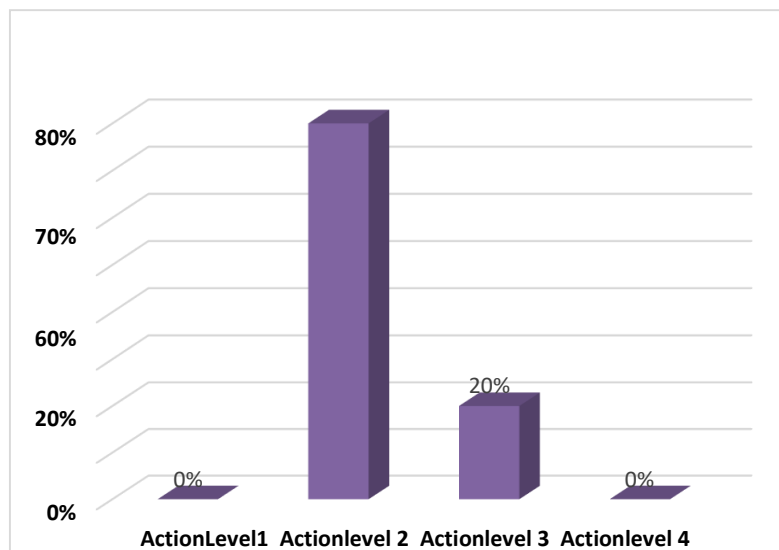
Forearm support	51.42%	48.57%
Correct posture awareness	74.28%	25.71%
Forward Head	54.28%	45.71%

GRAPH 3: RULA GRAND SCORE



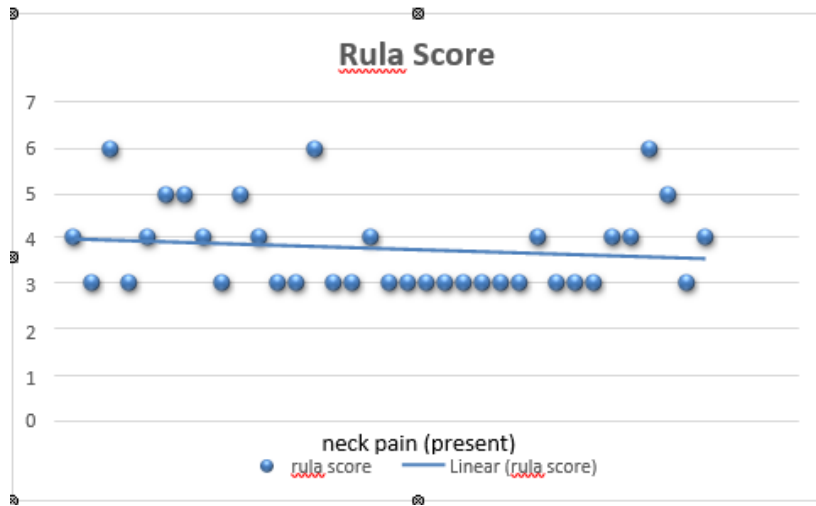
RULA score	1	2	3	4	5	6	7
No of subjects	0	0	19	9	4	3	0

GRAPH 4: RULA INTERPRETATION



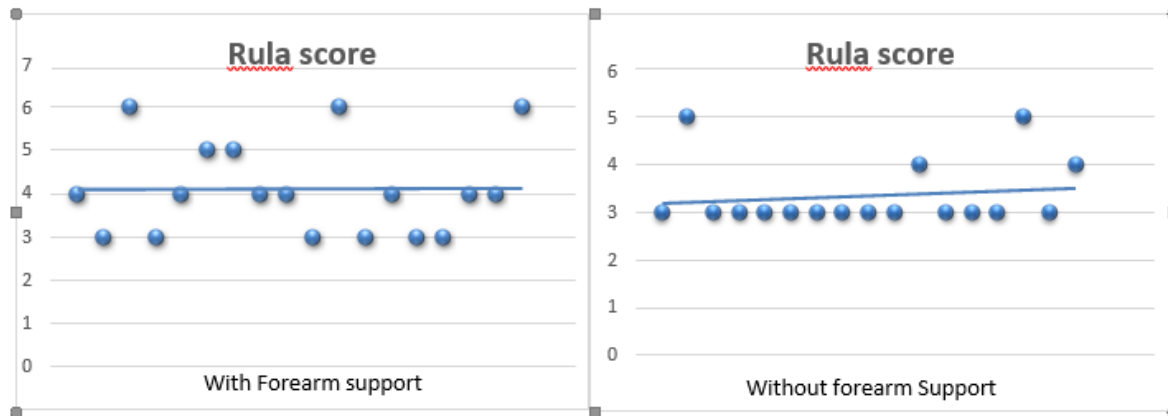
ActionLevel1(1-2)	0%
Actionlevel2(3-4)	80%
Actionlevel3(5&6)	20%
Actionlevel4(7& above)	0%

GRAPH 5: THE RELATIONSHIP BETWEEN NECK PAIN AND RULA SCORE



Region	Percentage	Significance	SPEARMAN'S CORRELATION COEFFICIENT	Relationship with RULA
Neck	100%	1		Exists
Upper Back	45.71%	0.092	0.388	Does not exist
Shoulder	51.42%	0.247	0.009	Does not exist
Elbow	25.71%	0.253	-0.029	Does not exist
Low Back	62.85%	0.193	-0.113	Does not exist

GRAPH 6: RELATIONSHIP BETWEEN ERGONOMIC FACTORS AND RULA SCORE



FACTORS	CHI SQUARE SIGNIFICANCE	SPEARMAN'S CORRELATION COEFFICIENT	CORRELATION
Lean Forward	0.741	-0.172	VERYWEAK
Forearm support	0.04	-0.418	MODERATE
Microscopic work at a stretch	0.495	-0.367	WEAK
Correct posture awareness	0.985	0.004	VERYWEAK
Forward Head	0.403	-0.194	VERYWEAK

Out of the 35 subjects, 72% were females and 28% were males. The mean age group was 45.14 ± 9.87 and 46.12 ± 7.03 respectively. They had work experience of 14.11 ± 7.34 years in this field. These subjects had a microscopic work of 27.05 ± 19.14 minutes at a stretch every day with a break of 9.86 ± 9.23 minutes daily (Table.1). Neck pain was the most prevalent (100%) among the subjects followed by low back pain (62.15%), shoulder pain (51.42%), upper back (45.41%) and elbow pain (25.71%). 54.28% of subject's lean forward during microscope use and 51.42% of subjects have forearm support. 74.28% subjects have correct posture awareness for microscope work but still 54.28% have forward head posture (Graph.1). 19 subjects have a RULA score of 3, 9 subjects have a RULA score of 4, 4 subjects have a RULA score of 5, 3 subjects have a RULA score of 6. None of the subjects have score between 1 & 2 and score 7 and above (Graph.3). 80% of the subjects lie in action level 2, 20% of the subjects lie in action level 3, none of them lie in action level 1 & 4 (Graph.4). Neck pain has very strong statistically significant correlation with RULA score. There was no significant relationship between other pain regions (shoulder pain, upper back pain, elbow pain and low back pain) with RULA score (Graph.5). Out of the ergonomic factors assessed and as mentioned in the table there is a statistically significant association between forearm support and RULA score and there is a moderate association of forearm support with RULA score which suggests that an increase in the forearm support can reduce the overall RULA score (Graph.5).

DISCUSSION

Musculoskeletal problems are faced by everyone in our lives. There was a strong evidence that High levels of static contraction, prolonged static loads, and awkward postures were associated with an increased risk for WRMSDs (15). Maintaining such postures for a long period of time eventually leads to pain and fatigue. Musculoskeletal disorders have evolved as the most common occupational injuries and one of the risk factors affecting the worker ability, efficacy and decreased productivity at work (25). A clinical laboratory technician who uses microscope on daily basis needs to maintain static posture for a long period of time. During microscopic work, the posture required to maintain is very awkward and maintaining it for long period of time may lead them to pain and make them prone to develop MSK disorders. Therefore, it was the need of the hour to assess the ergonomic risk for developing MSDs in these technicians so that appropriate actions can be taken.

Our study was carried out on 35 lab technicians from Mumbai. Both males and females within age group 46.12 ± 7.03 and 45.14 ± 9.87 respectively were included. Employees with minimum of 2 years of experience in daily microscopic work were included in the study and those with less than 2 years of experience and previous neck trauma were excluded from the study. These employees had an average work experience of 14.11 ± 7.34 years. They work for 27.05 ± 19.14 minutes at a stretch on the microscope with 9.86 ± 9.23 minutes of break in between. (Table 1)

Graph 1 shows the prevalence of pain in different areas as reported by the subjects. 100% prevalence of neck pain was found along with 45.71% of upper back pain, 51.42% of shoulder pain, 25.71% of elbow pain and 62.85% of low back pain. Significant prevalence of pain was found in the subjects due to maintenance of static postures of neck, arms, trunk for a long period of time (16). Static postures refer to physical exertion in which same position is held throughout the time. This exertion puts increased loads on the muscles and tendons which leads to fatigue (6). These situations often lead to overuse or repetitive syndromes, persistence of such symptoms thus becomes chronic. Repeated exposure to such situations often do not let the healing happen completely leading to relapse of the symptoms. Therefore, these practicing professionals are at high risk for the development of MSDs of the neck, upper back, lower back, shoulders, and upper extremities related to cumulative trauma (15).

Graph 3 AND Graph 4 shows the grand RULA score of the subjects. 19 subjects had a score of 3, 9 subjects had a score of 4, 4 subjects had a score of 5, 3 subjects had a score of 6. None of the subjects had the score of 7 and above. According to the interpretation of the RULA scale, 80% of the subjects lie in the action level 2 category and 20% of the subjects lie in the action level 3 category. This means that the subjects in action level 2 require change in posture and further investigations should be done. Subjects in action level 3 require changes in posture and further investigations soon. Subjects reported long hours of working on microscope and short break durations. By nature, work with microscopes demands precision and the ability to concentrate over long periods of time.

Looking through a microscope requires keeping the head in the same exact position for long period. Also, requires forward or side abduction movements of the upper extremities in order for the adjustment knobs (5). Such kind of occupations put increase load or forces on the muscles and tendons which contribute to fatigue (6). Some studies show that prevalence of musculoskeletal pain was positively associated with work hours. Indeed prolonged static contractions lead to accumulation of lactic acid, reduction of oxygen levels, and fatigue and pain. Chubine also highlighted this issue, but this finding is inconsistent with the results of Marshall et al. [21], Chamani et al. [22], and Al Wazzan et al. [23]. In a similar study, Seraji [24] found that the pain reported in different body parts was related to the working conditions associated with the same body parts. Electromyography (EMG) examination of microscopists have revealed that, after 4 hours of work with a microscope, muscle strain in the neck and shoulder region and in the back is 25%–65% greater than at the beginning of the work [26]. Correct postural awareness was found in 74.2% of the subjects. These subjects were aware about the correct posture to be assumed during microscopic work and have adopted changes accordingly. The rest were not aware and so continued to maintain the same posture since years. Though very weak correlation was found between postural awareness and RULA score.

We also have found out that 54.28% of the subjects have forward head posture and 68.57% have rounded shoulders. A forward head posture (FHP) involves increased flexion of lower cervical vertebrae and the upper thoracic regions, increased extension of upper cervical vertebrae and extension of the occiput on C1 [19]. The FHP is considered to co-exist with hyper-extension of the upper cervical spine, flattening of lower cervical spine, rounding of upper back, and elevation and protraction of shoulders. FHP may result in craniofacial pain, headache, neck pain and shoulder pain with decreased range of cervical motion, muscle stiffness and tenderness [20]. The posture required for microscopic works often strains the neck muscles causing pain and fatigue which eventually leads to muscle imbalance and faulty postures. Despite a high prevalence of forward head and rounded shoulders, very weak correlation was found with RULA score.

Despite the percentage of pain prevalence in different regions, only neck pain shows to have a statistically very strong correlation with RULA score. Rest of the areas such as shoulder, upper back, elbow and low back did not show significant correlation with RULA score. Few studies showed that the prevalence of these disorders in the upper body such as neck, shoulder and hand is high, which can be due to job nature and using inappropriate posture, using excessive force and excessive use of the upper limb [16]. Another factor that had moderate negative significance was forearm support. 51.42% of the subjects have supported forearms during microscopic work. The result states that more is the forearm support, less is the RULA score. The other ergonomic factor considered was leaning forward during microscopic work. 54.28% of the subjects used to lean forward for using the microscope. But no significant correlation was found to

exist between leaning forward and RULA score. Evaluating the relationship between pain, posture and RULA score, showed that despite high prevalence of pain in different regions and ergonomic factors considered, neck pain and forearm support showed to have statistically significant correlation with RULA score.

Based on the obtained result in the study it was concluded that the clinical laboratory technicians has mild to moderate ergonomic physical risk. Out of identified ergonomic risk factors presences of neck pain and forearm support during work has found to be the most associated factors for increase in RULA score .

CONCLUSION

We conclude that the physical ergonomic risk is mild to moderate in clinical laboratory technicians, demanding early changes in posture and further investigation. Neck pain and forearm support during work were attributed as risk factors for increase in RULA score.

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