ASSESSMENT OF POSTURE RELATED MUSCULOSKELETAL RISK LEVELS IN ARCHITECTURE STUDENTS USING REBA

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ABSTRACT

Background: Architecture is defined as an art and science of designing buildings and structures. And the professional who exemplifies it is known as an Architect. An architect requires commendable intellectual in the fields of engineering, logistics, geometry, building techniques, functional designs and ergonomics. Architect students are involved in tasks like drawing and drafting and also planning and making models for their educational purposes and practice. Most of their working task are subjective and requires repetitive movements and static postures in them leading to musculoskeletal disorders. There are evidences in literatures which state that the musculoskeletal disorders among architecture students are high and that the most commonly affected areas are the neck, low back and shoulder in the decreasing order of the prevalence. There are literatures which states that the architectural educational standards in terms of design theory, technical system, design documentation and professional practice varies highly across the world. And also there is dearth of literature regarding ergonomic posture related risk of musculoskeletal disorders among architecture students.

Methodology: In this study, 51 subjects both male and female were included. Of the 51 subjects, 21 subjects were Female and 30 subjects were Male. The Mean Age, Weight, Height and working hours were 19.57 years, 52.06 kg, 185.28cms and 8.63 hours respectively. Postures using REBA score sheet were evaluated based on the most difficult work tasks (based on observation and interview), the posture that was sustained for a longer period of time.

Results: Body posture was evaluated using REBA sheet and it can be concluded that the major areas susceptible to uncomfortable and painful working postures were trunk and upper extremity having the most frequent risk reported. Followed by the neck and wrist having moderate risk and the least frequent area involved were legs and lower arm position.

Conclusion: The study concludes that almost all of the architecture student’s fall under moderate risk of musculoskeletal disorders and require intervention and awareness about postural correction exercises to prevent further musculoskeletal injuries.

INTRODUCTION

Architecture is defined as an art and science of designing buildings and structures. And the professional who exemplifies it is known as an Architect. An architect requires commendable intellectual in the fields of engineering, logistics, geometry, building techniques, functional designs and ergonomics. An architect demands a certain ability to synthesize information coming from different areas, and architects often assume the position of leader, mediator or centralizer in groups made of very different specialists. Musculoskeletal disorders are described as an injury or dysfunction that commonly involves the supporting structures of the body as well as the nerves, muscles, bones and cartilages. They are collectively caused by repetitive movements or sustained poor and awkward positions. Architecture students are involved in tasks like drawing and drafting and also planning and making models for their educational purposes and practice. Most of their working task are subjective and requires repetitive movements and static postures in them leading to these disorders. Architecture is not the same profession in today’s industrial world we live in.

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Every object is design by someone who is specially trained to do just than this, the name architecture was given to experts who plan, design and construct buildings and structures. Architectural educational standards are different across the world in terms of design theory, technical systems, design documentation and professional practice. \(^{(3)}\)

While we often talk in terms of modelling, hand drawing and sketching remain the starting point for the majority of architects. They help an architect convey an idea or express a design quickly in the early concept design phase. For many there’s also the fact that the brain and the hand can work together simultaneously, while the level of proficiency using a particular software package or device determines an architect’s ability to quickly and visually present ideas without a pencil. \(^{(4)}\)

There are literatures which states that the prevalence of work related musculoskeletal disorders among architect students were highest in the cervical region followed by lumbar region which may have been because of the faulty sitting posture of the students as they work for long hours and are habituated to sit with a slouched back which puts a lot of strain on the muscles. Along with this they frequently rotate their back to accommodate large drawing boards while working which adds up the stress to it. \(^{(5)}\) They are also shown to have work related shoulder pain. This occurs as a result of continuous upper limb activity like drawing, drafting and keyboard use without giving arm support. Thus, the muscles around the shoulder have to work extra to stabilize the shoulder so that the wrist and fingers are able to do fine and minute work like sketching and typing. \(^{(2)}\)

### Rapid Entire Body Assessment (REBA)

REBA (Rapid Entire Body Assessment) was developed by Hignett and MC Attanmey in 2000. It is used to assess the entire body postural musculoskeletal disorders and risk associated with the job tasks. A single worksheet is used to evaluate the entire body posture, forceful exertion, type of movement, action and repetitive work. There is no advanced degree or expensive equipment required for assessing. The evaluator just needs REBA worksheet and a pen. The worksheet scores for each of the following body region: wrist, forearm, elbows, shoulder, neck, trunk, back, legs and knee. The score is collected and compiled to form a single score that represents the level of musculoskeletal disorder risk. A score of 1 indicates negligible risk, no action required. A score of 2-3 indicates low risk, change may be needed. A score of 4-7 indicates medium risk, further investigations needs to be done and changes to me made soon. A score of 8-10 indicates High risk, investigate and implement change. A score of 11+ indicates very high risk, implement change.

Rapid entire body assessment (REBA) has been used to highlight the importance of prevention programs and to improve the working conditions that minimize the damage and improve the quality of life of workers and also productivity of small industries in developing countries. \(^{(3)}\) REBA is a convenient assessment scale to assess posture of jobs in several occupational settings, including industrial and health care jobs, construction, sawmill tasks, supermarket industries, school workshops, odontological services and for fire-fighters and emergency medical technicians. \(^{(6)}\)

There are literatures which compared three observational methods to assess ergonomically risk levels that are REBA, RULA and OWAS using data from a sample of 301 postures obtained from diverse industrial sectors. Results showed highest intra-rater reliability of REBA among OWAS and RULA. \(^{(6)}\)

A study done by David et al compared REBA with other 14 observational methods to assess ergonomic work related musculoskeletal disorders risk in terms of main features and functions and exposure factor. The paper concluded that REBA is freely available assessment scale, which allows assessment of the whole body including lower limbs. It is considered to be the best matched method to the needs of occupational safety and health practitioners who have limited time and resources. \(^{(6)}\)

In a research paperwork done by Al Madani D et al concluded that REBA method appeared to be the only method capable of capturing the very uncomfortable postures that were frequently observed in a tree nursery sector (squatting, sitting on the ground, lumbar flexion greater than 90 and torso twisting). The study concluded better understanding of the differences between many risk assessment and a useful information for practitioner when choosing a method prior to an ergonomic intervention in an industry. \(^{(6)}\)

Since REBA was proven to be freely available assessment scale, which allows assessment of the whole body including lower limbs and is less time consuming; this study aims to use REBA as an outcome measure to evaluate the musculoskeletal risk factors in architecture students.

### Study Design

**Type of Study:** Cross Sectional Observational Study.

**Population:** Architecture Students of 4th And 5th Year.

**Duration of Study:** 18 Months

**Sample Design**

1. Type of Sampling: Convenient Sampling.
2. Sample Size: 51
3. Location: Metropolitan City

**Selection criteria:** Architecture students who will be willing to participate in the study, Undergraduate architecture students of 4th and 5th year in the age group of 18-25 years including both male and female were included in the study. Architecture students having any musculoskeletal deformities or injuries, having any neurological problems or any endocrine disorders and a BMI <18 and >25 were excluded from the study.

**Measurement Tools:** REBA Worksheet, Pen/pencil, Adhesive marker, Ruler.

### METHODOLOGY

Procedure: 51 architecture students who were willing to participate in the study was been included. All the subjects were screened as per the inclusion and the exclusion criteria. Height and weight of the subject was noted and BMI was calculated. The subjects were explained about the procedure and the purpose of this study. A written informed consent form were taken from all the subjects prior to the study. All the subjects were interviewed and evaluated to understand their work/tasks and demands. The students standing postures and movements was observed during their several working cycles.
Postures were evaluated based on the most difficult work tasks (based on observation and interview), the posture that was sustained for a longer period of time and posture in standing where highest loading takes place. REBA is quick, easy, valid, and reliable and less time consuming method to assess ergonomic posture related musculoskeletal disorders risk. After evaluating and observing the posture bilateral evaluation were done.

**Reba (Rapid Entire Body Assessment):** The REBA worksheet is divided into two sections: Section A and Section B. Section A which is on the left side covers the neck, trunk and leg. Section B which is on the right side covers the arm and wrist. Section A was evaluated first followed by Section B.

**OBSERVATION AND RESULTS**

Data was collected on a data sheet and encoded for computerized analysis. Tables were made using Microsoft word and figures were plotted using Microsoft excel windows 10.

In this study, 51 subjects both male and female were included. Out of 51 subjects, Twenty-one (41.18%) subjects of the studied community were Female and thirty subjects (58.82%) were Male. The Mean Age, Weight, Height and working hours were 19.57 years, 52.06 kg, 185.28cms and 8.63 hours respectively. Postures were observed and analysed in various position during drafting using REBA sheet. The results of REBA score, Score A (D+E), Score B and Score C for 51 students, Score A (D+E) had a percentage of 27.78; Score C also had a percentage of 27.78 whereas Score B had a percentage of 16.67. Score A (D+E) comprises of summed scores for neck, leg and force load. Score B comprises of summed scores for Upper arm & Wrist, and coupling score Score C comprises of coupling score and Score B. REBA score from 1-10, 100% of the students fell into the category of Medium risk with REBA score ranging from 4-7.

**Table 1 REBA Score**

<table>
<thead>
<tr>
<th>Reba Score</th>
<th>1</th>
<th>2-3</th>
<th>4.7</th>
<th>8-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Level</td>
<td>Negligible</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Required action</td>
<td>None</td>
<td>May Be Necessary</td>
<td>Necessary</td>
<td>Necessary soon</td>
</tr>
<tr>
<td>Percentage of Students</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Work posture is the position and condition of the body or body parts during the performance of work. Good work posture is as important for the performance of tasks as it promotes health and minimizes stress and discomfort during work. Ergonomics design of work system is a pre-requisite for better health, safety and productivity. It is important to analyse working postures for detailed understanding of relationship between the working posture and work related musculoskeletal disorders. The analysis on the other hand also helps in identifying the awkward working postures which leads to discomfort, inconvenience and risk of injuries and illness to workers.

Muscular work in occupational activities can be roughly divided into four groups: heavy dynamic muscle work, manual materials handling, static work and repetitive work. Architecture students fall under the category of heavy dynamic muscle work as they have a significant role on the construction site and also they fall under the category of static work as they use various software sitting in front of the computers. In addition to that they are involved in designing and planning which involves repetitive work.

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**Fig 1 Components of REBA sheet.**

**Fig 2 REBA Score**
This study was carried out to assess the posture related musculoskeletal disorders in the architecture students studying in India. Among MSD’s reported study population, the highest risk reported area were of Trunk (22.48%) and upper arm position (19.11%) respectively, followed by neck (17.74%) and wrist (15.60%) and subsequently the leg (14.22%) and lower arm position (10.86%) having the lowest risk frequency.

A study conducted by Ilyas T. et al on 300 female architecture students from 1st to 4th year with 75 students in each year at Lahore College using a standardized Nordic questionnaire which was modified according to the musculoskeletal disorders. The result of this study showed that the musculoskeletal disorder frequency from 1st, 2nd, 3rd, and 4th year was 69.3%, 67.6%, 85.3% and 85.3% respectively and regional distribution for the prevalence amongst students were as follows neck (24.7%), low back (18%), shoulder (8%), ankle (7.3%), hip (5%), knee (4%), elbow (3.7%), upper back (3%). Wrist/hand (3%) and 76.7% of female architect students were reported to have at least one musculoskeletal symptom. The musculoskeletal disorders frequency were highest amongst 3rd year and 4th year with 64 out of 75 students with MSD’s followed by 1st and 2nd year with 52 and 50 students out of 75 affected.

Activities like drafting and sketching leads to students acquiring faulty postures. Also sitting for prolonged period of time has caused them to obtain a slouched back posture. Excessive strain is put on their back during drafting activity to accommodate large drawing boards while working. It was found that constant drafting with flexed spine and neck over a period of time might cause a forward head posture in these students leading to stretching of the anterior neck muscles and weak neck extensors to become shorter and go into spasm hence altering the neck biomechanics and later on causing neck pain. The muscles around the shoulders have to work to its maximum capacity in order to stabilize the shoulder when the upper limb is not supported so that fine movements like sketching and drafting can be carried out with the wrist and fingers. It was identified that the Height adjustment for drafting table, repetitive movements and sustained posture was a major cause of concern. Absence or improper arm rest on the chair, constant repetitive movement and stress on the wrist while drafting can lead to muscle fatigue, discomfort and decreased muscle performance.

Prolonged bending and twisting movements over a long period was observed which implies increase in the work of muscles and ligaments and also stretches the elastic disc between the vertebrae to maintain upper body in balance and therefore also, increases stress in lower back. No posture or movements ought to be kept at significant stretch of time. The more prominent the muscular effort (exerted force as a percentage of maximum force), the shorter the time it is maintained.

It was found that almost all the students were at a medium risk if they continue to work in the same posture, which may lead to musculoskeletal disorder risk in future. Corrective actions and ergonomic intervention are recommended. Reorganization of the working environment and redesigning of working methods during drafting and to do revaluation with REBA method to verify effectiveness of the changes is advised.

The Rapid Entire Body Assessment (REBA) is an ergonomic method which is used for assessing postures. The application of REBA has evolved over time. It started with photographs, paper and pen. Over time, progress was made using video recordings and employing analysis of this through software. Currently, some equipment is used to measure angles and evaluate in real time. The advantage of REBA is that it is cost effective and easy to apply with assessment of each body part. One of the major difference between using REBA is that it assess the lower extremities as well which is not considered in other evaluation methods like RULA.

In a study conducted by David et al., REBA was compared with other 14 observational methods to assess ergonomic work related musculoskeletal disorders risk in terms of main features and functions and exposure factor REBA was concluded to be a freely available assessment scale, which allows assessment of the whole body including lower limbs and the best matched method to the needs of occupational safety and health practitioners who have limited time and resources. REBA method has been applied in 24 different countries and on 91 cases with the highest number of application in India. In Asia it is more specifically applied in two sectors: “Manufacturing” and “Agriculture” and “forestry and fishing”. This study REBA is specifically used to assess an altogether different sector of education which involves Architect students studying in India and their musculoskeletal risk level depending on their working condition and posture.

CONCLUSION: Body posture was evaluated using REBA sheet and it can be concluded that the major areas susceptible to uncomfortable and painful working postures were trunk and upper extremity, having the most frequent risk reported. Followed by the neck and wrist having moderate risk and the least frequent area involved were legs and lower arm position. Thus this study concludes that almost all of the architecture student’s fall under moderate risk of musculoskeletal disorders and require intervention and awareness about postural correction exercises to prevent further musculoskeletal injuries.

Clinical Implications: Prevention of injury and musculoskeletal disorders and postural correction exercises should be main concern. It is significant to screen the issues of architect students by having a proper musculoskeletal risk assessment, task analysis, and student’s interview, observation of their behaviour and worksite analysis. Ergonomic advice and workplace modification like change in the design of the drafting table, physical workspace and environment can improve student’s performance.

References
8. Laurig W, Vedder J. THE NATURE AND AIMS OF ERGONOMICS.
11. Attwood DA, Deeb JM, Danz-Reece ME. Ergonomic solutions for the process industries. Elsevier; 2004 Jan 24

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