

Prevalence of Postural Deviations among Industry Workers: A Pilot Study

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ABSTRACT

Background – Musculoskeletal disorders (MSDs) are one of the major concerns among industry workers which have a great influence on their work productivity. The aim of this study is to find out the prevalence of postural deviations among industry workers.

Method- Industry workers were selected based on inclusion and exclusion criteria. After taking consent, images of the workers were clicked using phone camera (Google Pixel 6a-12.2 megapixels) from all four different views and the GaitON software was used to analyze any deviations from normal posture. Accordingly, the study was conducted to determine the prevalence of postural deviations in workers.

Result- Descriptive statistics, including frequency and percentage, were calculated for the analysis. The data revealed that 99.57% had a transverse anterior superior iliac spine (ASIS) angle, 99.57% had a Horizontal acromion angle, 82.7% had a Forward head angle (FHA), 58.22% had shoulder angle and 29.11% had a Rearfoot angle.

Discussion- Industrial workers are exposed to a range of physical and ergonomic hazards on the job. Adopting awkward positions can contribute to the development of MSDs. Therefore, the study seeks to evaluate postural deviations among industry workers.

Conclusion- The current research indicates that poor posture among industrial workers can have adverse effect on their health, potentially causing musculoskeletal issues later on. Moreover, early retirement, disability, and absenteeism are all its occupational hazard.

Keywords – Ergonomics, Forward head angle (FHA), GaitON, Musculoskeletal disorder (MSD), Postural deviation

INTRODUCTION

Work is an integral part of every individual's daily life, and has a certain price. Health and work are interlinked with each other.¹ The human body is incredibly adaptable and capable of functioning in a variety of environments and circumstances.² Prolonged use of computers for professional purposes often involves frequent and extended periods at the workplace that are not always ergonomically designed. Moreover, among IT professionals, sedentary activity due to long static periods at the computer affects all body systems.³ Office workers often sit at least six hours a day at work. Prolonged sedentary work is associated with adverse health consequences, including musculoskeletal disorders, cardiovascular disorders, and type II diabetes. Sedentary lifestyle is well known to have impact on low circulatory demands and muscle activation.⁴

An ideal posture is considered when the external auditory canal is aligned with the vertical posture line. The vertical posture line, when viewed from the side, passes slightly in front of the ankle joint and the Centre of the knee joint, slightly behind the Centre of the hip joint, and passes through the shoulder joint and the external auditory meatus.⁵ The preservation of a particular postural pattern is necessary for every daily task. Any deviation from the normal posture has an adverse effect on the nearby joints and muscles, leading to musculoskeletal illnesses.⁶

Work-related musculoskeletal disorders (MSDs) are often associated with ergonomic risk factors such as contact stress and postural discomfort (alteration of normal working posture). MSD affects the neck, shoulders and lower back (LB) and has a significant impact on a person's health and work performance.⁷ Musculo-

skeletal disease is a multifactorial phenomenon, in which psycho- social causes can play a significant role.⁸ Work-related MSD accounts for 70– 80% in industrialized countries, demonstrating the need for therapeutic interventions.⁷

Data suggest that neck and lower extremity pain may be associated with sitting for long periods of time at work, and upper extremity problems may be associated with computer use. Prolonged sitting can also be a factor in exacerbating back pain when combined with uncomfortable positions (e.g., sitting forward and not upright) or whole-body vibrations. In particular, office workers spend many hours sitting, on average 75% of their working time is sitting and most of this sitting time accumulates over extended, uninterrupted periods of 30 minutes or more.

The most common musculoskeletal problems in office workers are neck, shoulder and lower back pain. The direction of causality (i.e., whether pain affects movement, vice versa, or both) remains unclear.⁹

Disorders of the musculoskeletal system occupy an important place in the disease statistics of all industrialized countries.

Although there are many diversification based on occupation, regional, social insurance organization, work culture etc., more than one-fifth of all lost working days are due to musculoskeletal and connective tissue diseases.⁸ Therefore, the aim of this study was to find out the prevalence of different posture deviations such as forward head posture, rounded shoulder posture, pelvic tilt and foot over-pronation using GaitON software (a motion analysis system used to analyze posture, biomechanics, gait etc) and help detect

future risks associated with these conditions among workers in the industry.

GaitON by uptime technologies analyses the standing posture of the patient. Its posture analysis protocol identifies key postural deviations from multiple views and export all data to report. It helps in comparing deviations with the help of plumb line.

MATERIALS AND METHOD

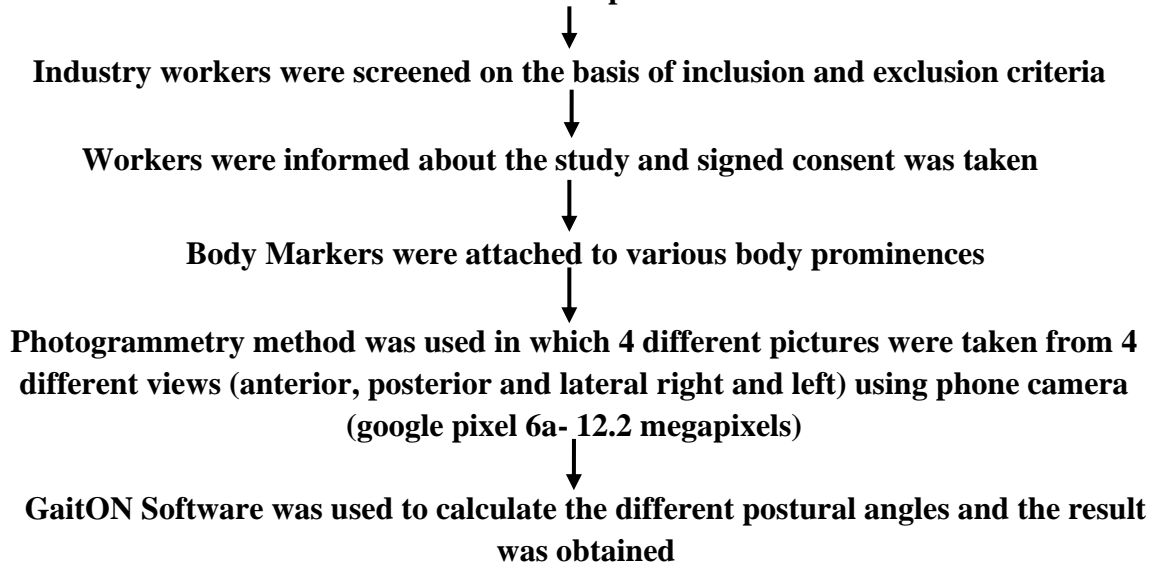
The study was conducted from July to September 2023. Signed consent was obtained from all the participants before the study. Purposive sampling was utilized to select participants from various industries of Raipur, Chhattisgarh. The sample size of the study was 237. The

inclusion criteria were population aged between 20 to 60 years. The subject with previous injury history, congenital anomalies, or symptomatic cervical spine deformities, cervical spine pathology, cervical surgery, cervical spine fracture, and psychological issue were the exclusion for the study.

Experimental procedure

The selection of population was based on the inclusion and exclusion criteria. After obtaining consent, images of the workers were captured from 4 different views i.e., Anterior, posterior, right lateral view and left lateral view. The postural parameters were calculated using GaitON software.

Flowchart of the procedure-



Postural parameters-

Forward head angle (FHA)-forward head posture
Shoulder angle- Rounded Shoulder posture
Rearfoot angle- Flat-foot

Horizontal alignment of ASIS- Pelvic Tilt/Asymmetry
Horizontal angle of acromion-
Shoulder levels at horizontal view



Figure 1 & 2: Anterior and posterior view for angle deviations

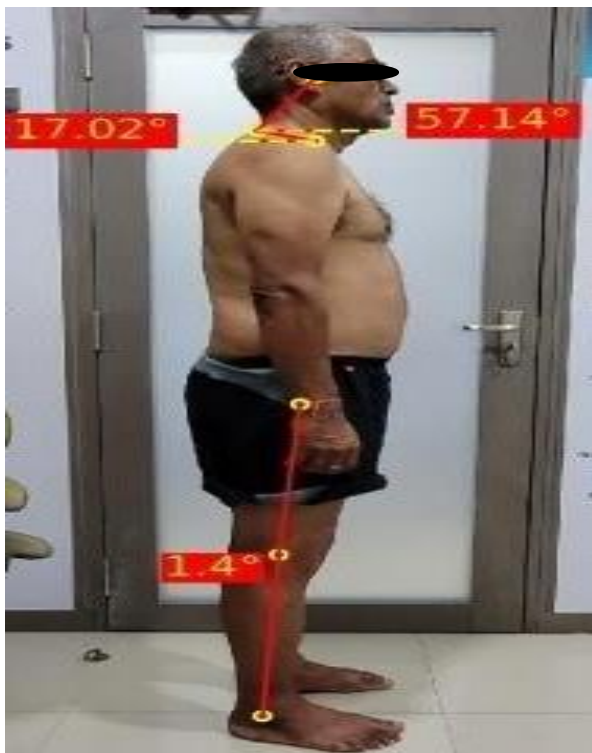


Figure 3 & 4: Left lateral view and Right lateral view

motion analysis system designed for clinicians, equipped with inbuilt modules for posture, walking gait, running gait & sports biomechanical analysis. It uses cameras to capture the patient's motion and generates a comprehensive report highlighting abnormal biomechanics.¹⁰

STATISTICAL METHOD AND RESULT

The data was statistically analyzed using IBM SPSS STATISTICS VERSION. Statistical tests used in the present study was Descriptive statistics in which frequency and percentage was calculated.

VARIABLE	MEAN ± SD
AGE	47.4±8.45
HEIGHT	168.14±7.78
WEIGHT	76.74±15.04
FHA	55.32±5.42
SHOULDER ANGLE	54.11±10.95
REARFOOT ANGLE	4.19±2.73
HORIZONTAL ALIGNMENT OF ASIS	-1.92±2.34
HORIZONTAL ANGLE OF ACROMION	0.29±2.34

The values are presented as mean ± standard deviation as data followed normal distribution

VARIABLE/PARAMETER	FREQUENCY	PERCENTAGE
FHA	196	82.70
SHOULDER ANGLE	138	58.22
REARFOOT ANGLE	69	29.11
HORIZONTAL ALIGNMENT OF ASIS	236	99.57
HORIZONTAL ANGLE OF ACROMION	236	99.57

Frequency and percentage distribution of postural deviation among workers

DISCUSSION

Industrial workers face a range of physical and ergonomic hazards during their job life. Adopting awkward positions can contribute to the development of MSDs.¹¹ Therefore, the study seeks to evaluate postural deviations among industry workers by using GaitOn software. The findings of current study showed that 99.57% had anterior pelvic tilt, 99.57% had abnormal shoulder level at the horizontal view, 82.7% had Forward head posture, 58.22% had rounded shoulder posture and 29.11% had an over pronation at foot.

Pelvic Tilt/Asymmetry- In the current study it was found out that 99.57% of workers had poor alignment of ASIS in horizontal plane, indicating pelvic tilt or asymmetry. Research conducted by Lee Herrington in 2016 says that when there is asymmetry within the pelvic structures, it is believed to trigger a series of postural adjustments, making the person more susceptible to various neuromusculoskeletal problems. For instance, research indicates that existence of pelvic alignment asymmetry can serve as an indicator of SIJ dysfunction.¹² Furthermore a 2023 analysis conducted by Shu Hao Du and colleagues highlighted the significant connection between postural imbalances and low back pain. Abnormal postural behavior is frequently a potential risk factor for low back pain and lumbar injury, and spinal postural examination is a crucial component in the assessment of low back pain.¹⁷

Shoulder level at horizontal view-In the current study it was found out that 99.57% Several studies have also pointed out that FHP can be attributed to inadequate chair and desk ergonomics, improper computer

workers had abnormal alignment of their shoulder levels. The horizontal angle to the acromion typically refers to the angle between a reference line, often a vertical line, and a line drawn to the acromion process of the scapula.

A study conducted by Leticia B Janaurio et al in 2014 highlighted that when engaging in tasks like office work, the neck and shoulder region is especially subjected to low- level, monotonous workload for extended periods of time. This, combined with exposure to vibration, temperature, and lighting, this overload is linked to numerous additional risk factors, including a fast-paced work environment, clumsy or repetitive actions, maintaining awkward postures, or sitting still.¹⁸ All of these factors collectively contribute to the abnormal alignment observed in the shoulder levels of the workers in this study.

Forward Head Posture – In the current study, it was revealed that 82.7% of workers exhibited FHP, a condition where the head is positioned too far forward in relation to a vertical reference line.¹³ Research conducted by Sun et al. in 2014, it was observed that FHP tends to increase with age in healthy individuals, likely due to reduced range of motion.¹⁴ Another study focused on IT professionals and ergonomics found that the degree of neck disability among this group is influenced by both the lack of a suitable work environment and insufficient physical activity. The research indicated a positive correlation between FHP, age, work experience, and poor workplace ergonomics.³

positioning, and a lack of attention to body posture while working. Addressing FHP early is crucial, as it can lead to various

health issues such as neck pain, headaches, shoulder discomfort and even changes in spinal curvature over time.

Rounded Shoulder Posture- In the current study, it was identified that 58.22% had rounded shoulder posture, it can be described as a posture characterized by acromion protraction in front of the line of gravity, shoulder protraction, and downward rotation as well as anterior.¹⁶ Research done by Young Lee et al in 2017 says that Changes in physical functions that occur due to rounded shoulders can cause one or more abnormal conditions in a complex structure consisting of the head, neck, and shoulders.

Flat-foot- In the current study 29.11% workers were having flat-foot. Flat foot or pes planus, is a condition where the arches of the feet collapse, causing the foot to excessively roll inward (pronation). This leads to the internal rotation of the shin and thigh bones, as well as an anterior tilt of the pelvis. This abnormality disrupts the natural movement of the lower limbs, alters how the body responds to ground forces, affects muscle function, and impacts overall walking patterns.

Research done by Adel F Almutairi et al. in 2021 says that participants with flat feet had a prevalence of LBP of 65.9%, while those with regular feet had a prevalence of 32.8%. The study found that those with flat feet who did not engage in physical exercise had a higher prevalence of chronic low back pain than those who did. There are other factors that also contributes in this like adhering to a balanced diet and engaging in regular exercise results in thinner feet, higher/stiffer arches, and stronger ankle muscles.¹⁹

The development of a person's posture is shaped by a multitude of factors, encompassing diet, physical fitness, ability to prevent defects and diseases, and various environmental and developmental factors. In this study, uncontrollable variables such as daily activities, rest, nutrition, personal habits, and methods of sitting and standing could have impacted the results differently. This highlights a limitation of the research, emphasizing the need for future studies to consider and control for these variables to draw more definite conclusions.

CONCLUSION

The existing research indicates that inadequate posture among industrial workers can significantly jeopardize their health, potentially resulting in musculoskeletal disorders in the future. Additionally, this poor posture can diminish efficiency and productivity in the workplace.²⁰

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Nil.

Conflicts of interest

None.

Further Study

- 1) Sample can be taken from other parts of the India which can represent the diversity of morphology.
- 2) Relationship of the altered posture and the hours of working can be considered to find out risk for MSDs.
- 3) Data can be used to lower the population's future risk for MSDs.

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