Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 11 November 2023

Research Article

Prevalence of Work-Related Musculoskeletal Disorders among Diamond Industrial Workers: A Descriptive study

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DOI: 10.31080/ASOR.2023.06.0859

Received: September 08, 2023

Published: October 22, 2023

Abstract

Diamond industry in India is one of the most important industries, which creates employment and also contributes in the Indian Economy for growth. Diamond requires cutting and polishing. Quality check is done at every step. The Units involved in cutting, polishing and Quality check are: Bruting, Polishing and Quality Control. The workers involved in Diamond cutting and polishing requires prolonged sitting during the procedure and forward bent posture of neck is required to frequently see the diamond through the eye glass. Polishing (involves Top and Bottom units) is done with a device named Angoor involving Left Hand. In Bruting procedure, the machine is connected with a computer and the procedure is done by operating on a computer screen. Workers all around the world experience a range of occupation related musculoskeletal disorders depending on their task which affects their functionality and ultimately their overall performance. There are least research available in the field of Diamond industrial workers suffering with common work related Musculoskeletal Disorders in India. The aim of the study is to find out the prevalence of common work-related Musculoskeletal Disorders in Diamond Industrial Workers in India. Data was analysed using a descriptive analysis in MS Excel 2007. The Standardized Nordic Questionnaire was utilized as an outcome measure.

Keywords: WMSD; Diamond Industrial Workers; Diamond Workers; Posture in Diamond Workers; Nordic Questionnaire

Introduction

Since the beginning of recorded history, diamonds have been a part of Indian culture. India was one of the first nations to harvest diamonds after the discovery of the gem in the fourth century B.C. For hundreds of years, the size and brilliance of Indian diamonds have been cherished. India has become the largest diamond cutting centre in the world, and the diamonds cut and polished there are known around the world. With over 1 million cutters and polishers, India is the largest country in the world for the cutting and polishing of diamonds, handling more than 57% of the total value of the world's rough diamonds. India processes 57% of the world's diamonds, accounting for 80% of the cartage, 80% of the value, and 90% of the volume. India employs 94% of all diamond industry workers worldwide. Rough diamonds of all shapes, sizes, and grades, including those greater than 10 carats, are processed. India makes up around 80% of the global market in this industry in terms of carat. Mumbai, Surat, Ahmedabad, Bhavnagar, and a few minor towns in Gujarat are home to the majority of India's diamond cutting and polishing facilities [1].

The same fundamental processes are used in gem diamond production now as they have in the past

- Choosing or classifying the diamond-rough. This entails assessing each diamond for prospective grades in colour, clarity, and cutting.
- Marking the raw material for production.
- Cutting the rough crystal with a saw or cleaver.
- Girdle bruising.
- Smoothing out the facets.

Some of these processes are performed several times for large diamonds, such as sawing, table polishing, bruting, and blocking (polishing four or eight facets).Rebruting temporary polishing (8 facets) while repolishing the table. - finishing touches on the table buffing, bruiting, and polishing. This results from ongoing efforts to enhance the stone's ultimate appearance and the yield from the rough [2].

The primary task of a diamond polisher is to polish a stone using a vibrating tool called a grinder. Following each polish, they must examine each cut with an eyepiece. They are mostly sitting in the position they have acquired. Since their line of work requires a variety of physical activities, including continuous, repetitive motions, uncomfortable postures when sitting for extended periods of time, and exposure to vibrations, several body parts, including the neck, upper and lower back, shoulder, elbow, wrist, and hand and fingers, are subjected to a variety of mechanical stressors. A micro motion study and biomechanical analysis of the motion patterns used in the diamond polishing industry show that the hand and arm movements are particularly intense, involving high acceleration, quick movement, and a significant amount of repetition in brief cycles [3,4]. Figure 1.1 and figure 1.2 represents the position of the diamond polisher (top and bottom respectively), figure 1.3 and figure 1.4 represents the position of a diamond worker in bruting unit, figure 1.5 and figure 1.6 represents the position of the diamond worker in Quality Control unit.

Figure 1.1

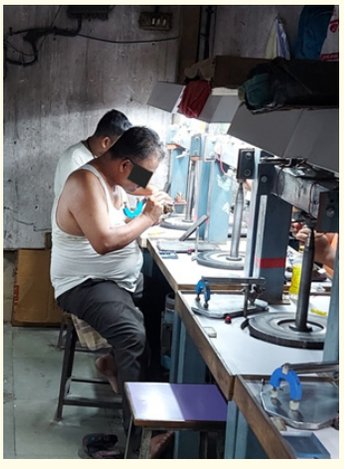

Figure 1.2

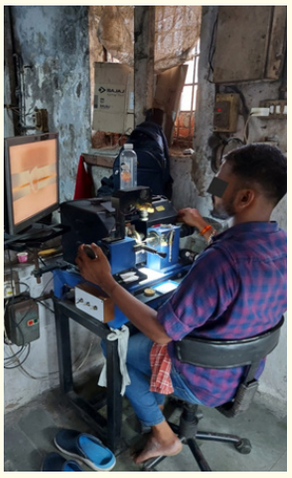

Figure 1.3

Figure 1.4

Figure 1.5

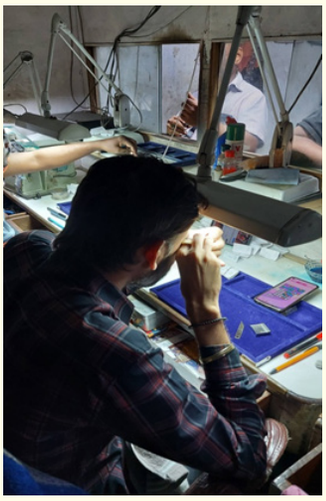

Figure 1.6

The association between labor and some musculoskeletal problems caused by sudden, irregular movements and adopting awkward postures was first identified by the Italian physician Bernardino Ramazzini in the eighteenth century [5].

Disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, or spinal discs are referred to as musculoskeletal disorders (MSDs). Musculoskeletal disorders (MSDs) that are exacerbated or persistent by work conditions are referred to as "work-related musculoskeletal disorders" (WMSDs). MSDs are among the most significant cited issues at work today [6].

Employers, unions, workers, ergonomists, industrial engineers, and specialists in occupational health and safety are all becoming more concerned with work-related musculoskeletal problems [7].

The adoption of surveillance systems is one aspect of preventing upper limb work-related musculoskeletal problems. These systems are based on numerous data sources, including systems that are population-based or corporate-wide. The creation and application of these systems implies the existence of suitable tools for assessing the worker's state of health [8,9].

Some authors have suggested a multi-level model for the surveillance of upper-limb work-related musculoskeletal disorders and their risk factors, including a first level using questionnaires and checklists for a rapid assessment and a second level including clinical examinations and an in-depth job analysis by trained healthcare professionals [8,10,11].

The most widely used symptom questionnaire is the standardized Nordic questionnaire, which was published in 1987. The published version has distinct portions for the neck, shoulders, and lower back [12].

Materials and Methods

It is a descriptive study with observation survey. The sample size was represented by 199 Diamond industrial workers who met the following criteria.

Inclusion criteria

- Age between 18 to 60 years.
- Work experience not less than 1 year.
- Working hours 8 to 12 hours/day.
- Subjects willing to participate.

Exclusion criteria

- Surgical history related to musculoskeletal system.
- Recent history of any injury or trauma.
- Congenital and Acquired deformities.
- CNS related neurological conditions.

Outcome Measures: Standardised Nordic Questionnaire.

The Nordic Council of Ministers provided funding for the development of the Standardized Nordic Questionnaire [12]. It comprises of forced, organized, multiple-choice questions and can be used as an interview or a self-administered questionnaire [13].

Procedure

199 Diamond Workers were selected based on inclusion criteria from Vekariya Gems unit no. 410/411, Tanishka Industrial Estate, Dahisar (East) and other Diamond industrial units from Dahisar (East), Vasai (East) and Vasai (west). Each individual gave their informed consent. They were given self-administered questionnaires, and the Standardized Nordic questionnaire was used to measure WMSD. Their privacy remained intact. A standardized questionnaire called the Standardised Nordic Questionnaire uses forced-choice questions to identify body parts that are responsible for musculoskeletal issues. A body map that highlights the nine symptom sites-the neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees, and ankles/feet-helps with completion. When asked if they had experienced any musculoskeletal pain in the previous year or the previous week that stopped them from engaging in typical activity, respondents were required to provide accurate information, not just how they were feeling at the time. In order to obtain accurate data, we translated the questionnaire into a language that they could comprehend and completed. MS Excel 2007 was used to perform a descriptive analysis after receiving the data.

Results

Out of the total 79 samples collected in POLISHING (BOTTOM) we concluded the following.

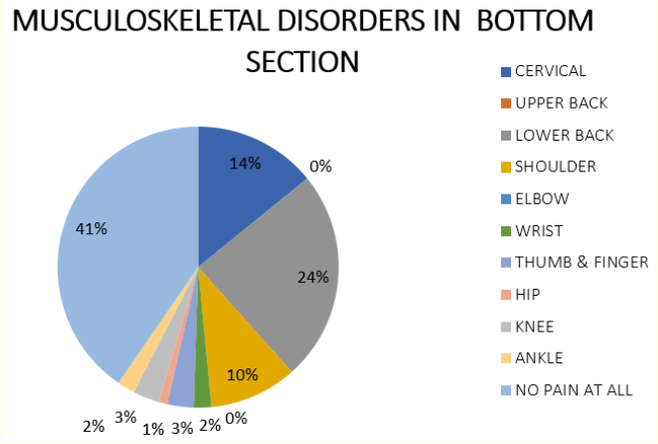

Figure a

Out of the total 74 samples collected in POLISHING (TOP) we concluded the following.

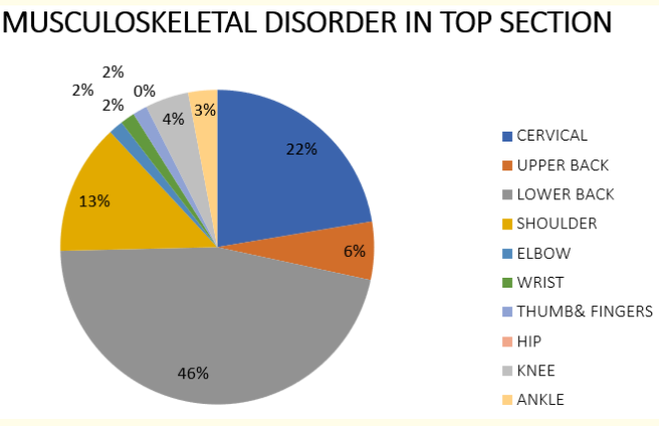

Figure b

Out of the total 40 samples collected in QUALITY CONTROL we concluded the following.

Out of the total 6 samples collected in BRUTING we concluded the following.

Representation of WMSD in different sections in Diamond Industry.

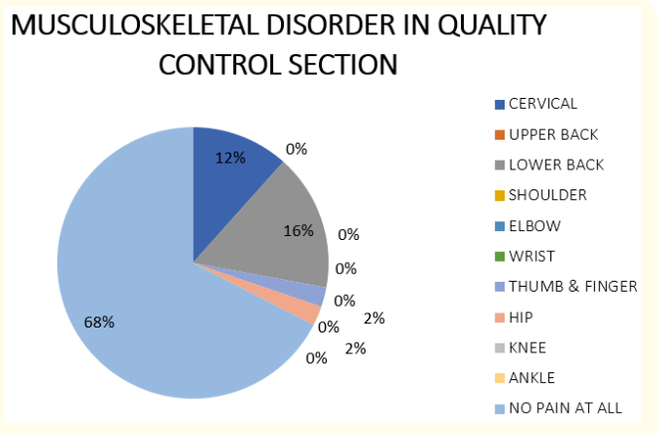

Figure c

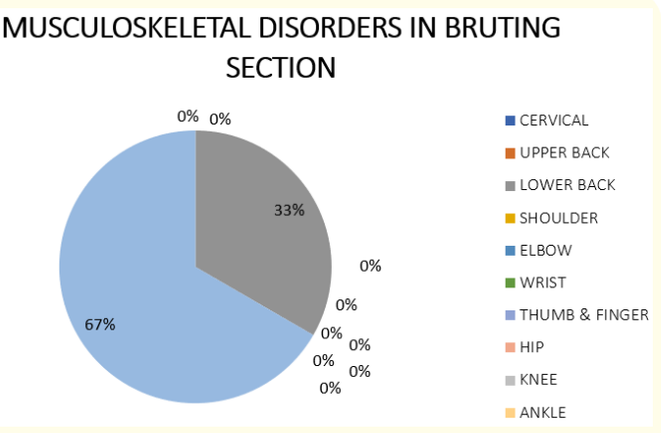

Figure d

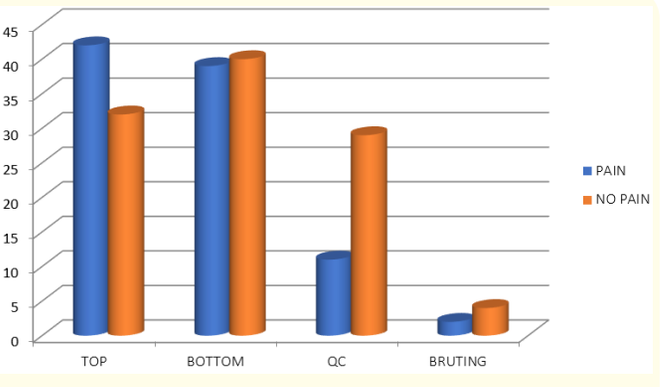

Figure e

Thus we conclude that out of the 199 samples that we have collected so far, 47% are suffering from work related musculoskeletal disorders.

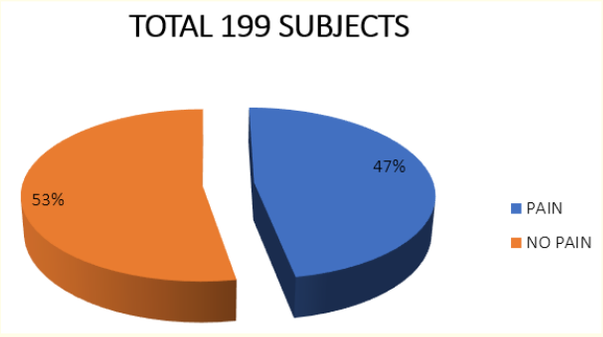

Figure f

Discussion

Our study's objective is to determine the frequency of work-related musculoskeletal problems among employees of the Diamond Industrial. Out of the total 79 samples collected in POLISHING (BOTTOM) unit we concluded the following- 41% had elbow pain, 24% had Low back pain, 14% had cervical spine pain, 10% had shoulder pain, 3% had Thumb and Fingers and Knee pain each, 2% had wrist and hip pain each. Out of the total 74 samples collected in POLISHING (TOP) unit we concluded the following- 46% had Low back pain, 6% had upper back pain, 22% had cervical spine pain, 13% had shoulder pain, 4% had Knee pain each, 3% had ankle pain, 2% had elbow, wrist, thumb and fingers pain each. Out of the total 40 samples collected in QUALITY CONTROL unit we concluded the following- 16% had Low back pain, 12% had cervical spine pain, 2% had Hip, thumb and fingers pain each. Out of the total 6 samples collected in BRUTING unit we concluded the following- 33% had Low back pain, 67% Thumb and fingers pain. The overall results obtained in our study indicates that out of 199 subjects, 47% of the subjects had work related musculoskeletal disorder.

Prolonged sitting in an awkward posture creates an overuse discomfort on the postural muscles, ligaments, and other soft tissues. A diamond worker have to sit for a prolonged period of time in a flexed posture of neck for polishing and shaping the diamond skillfully and with good precision.

If excessive postural tension is to be avoided, the head and neck should not flex forward more than 15 degrees. There is strong evidence that chronic neck and shoulder pain is linked to frequent or prolonged flexion of the head and neck beyond this [14].

Rapid work pace and repetitive motion patterns, inadequate rest periods, heavy lifting and other strenuous manual labor, out-of-neutral body postures (either dynamic or static) of the wrists, elbows, or shoulders, mechanical pressure concentrations, vibration (both segmental and whole-body), and low temperature are the main physical factors that contribute to musculoskeletal disorders [15].

Greater co-activation of synergistic and antagonistic muscles is required to stabilize the joints when a body part needs to be moved quickly and with control. The result is a magnified joint loading since many of the affected muscles will be competing with one another [16].

Only if the various body parts are supported and kept in proper relationship to the base of support, such as the feet, can a stable posture be maintained. If the support of the body mass is provided by soft tissues rather than bone, postures might be stable yet stressful [17].

According to one study, the most common musculoskeletal discomfort in diamond polishers was in the low back, followed by the neck and fingers, while in diamond assorters, it was in the elbow, then the neck. The stance adopted by diamond workers while they were at work was mostly a protracted static posture that induces muscle exhaustion and muscle imbalance, which results in protective muscle contraction and muscle spasm [18].

The other research indicate that forward bending posture is a significant risk factor for the development of spine discomfort. When bending, the spine's front structures are compressed, and its posterior structures are tensed, both of which cause discomfort. Prolonged abduction and forward flexion of the upper arm may put stress on the gleno-humeral capsule of the shoulder joint, resulting in pain in the upper extremity's shoulder, elbow, and fingers. Since the arm must be kept in this immobile position against gravity for several hours, the muscles will become fatigued and painful. Repeated elbow flexion and extension can result in modest soft tissue damage, and prolonged elbow placement on the table while working can compress the ulnar nerve, resulting in tingling or numbness. There are pinch prehension movements involving the pad of the finger and opposition of the thumb when polishing and sorting the diamond while holding the diamond in one hand and the eyeglass in the other. The pain is brought on by the wrist and fingers moving in tiny, repeated motions [3,4,19].

Both diamond polishers and assorters had much higher rates of work absence from musculoskeletal pain. The workers' financial situations are likely to blame for their absenteeism from work since they prevent them from getting the proper medical care they need, which worsens their health. There is a rise in work absences among diamond employees as a result of the combined effects of physical, emotional, organizational, and environmental factors on musculoskeletal issues [20,21].

Limitation

These data characterize only one working industries (diamond) and may not be representative of the situation occurring in a highly urbanized society or in a different climate. Our population sample may be biased because working station and environment were different in a different factory, which was not accounted for in data collection. In all of these studies, the lack of a specific dependent variable other than the subjective complaint of the intensity of disability is problematic.

Future Scope of the Study

A more rigorous methodology (like randomized controlled trial) could be employed. Ergonomic advice and follow up session could be assessed.

Conclusion

The overall frequency of MSD among diamond workers is 47%; the lower back, neck, upper back, shoulder, and other joints are the most common among them.

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