

Assessment Of Biomechanical Risk Exposure In Diamond Assorters

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Abstract

Introduction: Diamond sorters due to their inevitable prolonged forward bend working posture in order to assort diamonds are prone to have musculoskeletal aches. Hence, the following study has been done to assess the risk exposure in them.

Methodology: A cross-sectional study was been done in Mumbai, India wherein a questionnaire with Nordic Pain Questionnaire was randomly distributed amongst 50 subjects of the study population. Rapid Entire Body Assessment (REBA) was used to assess biomechanical risk exposures at work place.

Result: Neck (38%) and Low back region (24%) was the commonest area of musculoskeletal pain in our study population. Almost the whole of the study population falls in medium (57%) and high risk (43%) category according to REBA.

Conclusion: Neck and low back region were most prevalent areas. Almost all of the study population falls in both medium and high risk category. Work demand made it difficult for workers to use ergonomically available setup.

Key words: Diamond sorters, musculoskeletal pain, risk

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I. Introduction

For thousands of years, diamonds have been an object of fascination, beauty, richness and capital value. Skillful artists through the ages have tried to enhance the beauty by finishing the structure and shape of this unique form of hard carbon.

In contrast to their tedious contribution to this field, very little has been done to improve their working condition and provide them with the facilities that may be the basic need for their job demand.

Assorters are required to work around 8-10 hours a day for 6 days a week with limited interval periods. Most commonly the posture adopted by them is that of a sitting with slouching of the upper trunk with neck flexion, elbows flexed resting on the table in front, wrist & fingers in mild amount of flexion. Keen and sharp observation of the diamonds is what is expected of them. Tools used by them include eye piece and tongs to examine the surface and internal structures to identify the flaws affecting the gem.

As there is paucity of literature review available about this profession we could come across only few studies. A study done by K A Mansukhani, C D'Souza on "Ulnar neuropathy at the elbow in diamond sorters", Indian J Medical Research 1991, Bombay Hospital [1]. Also, an unpublished study previously done by Dr. T A Dabholkar & Akanksha .R. Dave (2011) et al regarding "Common musculoskeletal problems in diamond sorters" found that musculoskeletal pain is very high among the diamond sorters and the commonest area of involvement is the neck region. Some of previous studies done on occupations like dentistry [2,3] & fish net industry [4]

we observed job demand is of equal proportion like diamond sorters. Hence like these occupations, exposure to work related risk factors can lead to cumulative trauma disorders. Hence this study aims at assessing prevalence as well as to do biomechanical analysis using REBA (Rapid Entire Body Assessment). Insight in to these areas could help us to give appropriate ergonomic advice and suggest rehabilitative measures

II. Material & Methodology

This cross-sectional study was conducted in Mumbai, Bharat Diamond Bourse, Bandra Kurla complex. Bharat diamond Bourse (BDB) is one of the largest and most sophisticated diamond centers in the world. Since 2010, over 4,000 members engaged in import and export, manufacturing and marketing of rough and polished diamonds. 100 diamond sorters working minimum for 6 months were considered in study. Workers with previous history of musculoskeletal or neurological involvement were excluded from study. Data were collected

via anonymous questionnaires. The questionnaire consisted of two parts and covered the Following items: (1) Personal details (including gender, age, job tenure, health, and medical background); and (2) musculoskeletal problems in different body regions. Nordic Pain Questionnaire was also filled by the subjects. Reported MSD symptoms were limited to the past 12 months. Further evaluation of work posture and work related risk factors were done using REBA .Before conducting study university ethics committee approval was taken .Consent was filled by every worker.

III. Results & Observation

Table 1: Demography of study population.

Age Group	[26-32yrs = 44%] [19-25yrs =34%]
Male : Female Ratio	7:1
Experience years	7±4.1
Dominance	88% Right / 12% left
No. of working hours/day	8.83hrs ± 2.31.

It had been observed that 44% subjects are in the age group of 26-32years and 34% in the age group of 19-25years with males forming the dominant part of the study population. 88% of them are right handed by dominance while only 12% are left handed. They would take only a 30-45mins lunch break which was according to the norms set for the employees.

Table 2: Common areas of pain.

Area	Neck	Shoulder	Upper back	Elbow	Wrist/ hand	Lower back	Hip/ thigh	Knee	Ankle/ feet
Percent	38%	4%	6%	2%	2%	24%	0%	2%	2%

Graph 1: Distribution of the REBA score.

Graph 2 a: Distribution of REBA score in subjects with >5 years of experience.

Graph 2b: Distribution of REBA score in subjects with <5 years of experience.

IV. Discussion

The most common area of musculoskeletal pain seen in our sample population is neck pain and low back pain as per the Nordic Pain Questionnaire which was distributed along with the questionnaire to the study population.

Neck pain : Neck pain was found to be most prevalent area (38%) in our study (Table 2). It has been observed that percentage of workers in high risk category has increased from 43% to 66% with advancing year of experience(Graph 2a & graph 2b) .Which indicates that ,work experience could increase possibility of ergonomic risk. work of diamond assorter demands them to do fine work .amount of concentration needed is more .This makes them work with forward bend posture while working. Forward bend posture increases the stress on cervical and lumbar spine due to abnormal loading on the ligaments and muscles and the work ability decreased gradually with both increased stress and pain [5]. The reason for neck pain is due to constant forward head posture during work for at least 2 hours at a stretch. Also, 62% of the subjects in our study were not having chair with arm rest available as a result involvement of entire upper back were also observed.

Lumbar pain: Pain in lower back was next prevalent area (24%) observed in our study (table 2).

Work profile of diamond assorters includes various tasks like, examination of diamonds or gems to ascertain the shape, cut, and width of cut stones, or to select the cuts that will result in the biggest, best quality stones.

For such work they need to fix posture and stabilize upper body. Sustained forward bent posture for prolong period of time comes at the cost of lower back pain. As a result the posterior longitudinal ligament and posterior fibers of the disc becomes excessively elongated and it also can result in increased intra-discal pressure which maybe injurious to the spinal column. About 94% of the subjects in our study had back support with their chairs but job demand is such that they need to constantly bend .which makes it impossible for them to use it. As a result the back still remains unsupported in spite of the back support. The height of the chair is adjustable and 94% of the subjects consider it appropriate for them, however 6% of the subjects felt that it is uncomfortable for them and strains their body.

Job stress: It has been seen that all the workers fall in the risk category irrespective of whether they have or not acquired a training programme. Workers were given strict target to complete the assortment of the diamond packet allotted to them each day. This maybe one of the reasons due to which they avoid taking frequent breaks during work in order to complete their targets. Repetition, awkward or static postures, high forces and contact stress these are the common causes stated to develop musculoskeletal disorders (MSDs) [6,7]. Elbows are unsupported in most of the sample population. This is probably due to lack of space on the assortment table or in order to accommodate more number of people on the same table. Ergonomic evaluation performed at the

diamond manufacturing set-up points to a great lack of engineering design which may be the leading cause of pain in these subjects. Assessment of biomechanical risk exposures using REBA has shown that 54% subjects fall in the high risk category while 46% subjects fall in the medium risk category (Graph 1). Which puts a stress on ergonomic consideration of these workers. An increased percentage of biomechanical risk with more practicing years is an alarming sign to be considered.

V. Conclusion

Neck and low back region is the most common area of musculoskeletal pain in our study. Almost all of the study population falls in both medium and high risk category.

VI. Recommendations

The nature of health problems faced by diamond assorters is evitable to a large extent by proper ergonomic advice and some precautionary measures during work. Following are some recommendations.

1. The table must be above the level of their elbows.
2. For precision work, the work surface should be higher (by up to 15cm) to improve task visibility and avoid an uncomfortable, stooped posture [8]
3. Eye piece must be kept closer to the body.
4. Elbow must be supported.
5. As neck bending is inevitable, bending of back can be avoided by keeping a small stool over the table such that the back is straight and using a lumbar roll.
6. A targeted exercise program can improve postural alignment related to forward head posture [9] Regular exercises such as chin tucks and shoulder retractions can be done along with neck stretching (side flexion and rotations), hence series of neck and shoulder stretches help alleviate tension in the upper back. [10]
7. Series of stretches for your deltoids, forearms, hands, chest and spine will help you stay productive [11] and low back stretching (back extension) is equally important.
8. At least a 10 minute break after every 45mins of sustained forward bend posture is necessary to stretch the structures that are getting strained while working.
9. Deep breathing exercises to induce relaxation can be done.

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