RESEARCH ARTICLE

Prevalence of work related musculoskeletal disorder: A potential threat to clay doll making sculptors

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Abstract

Background: Sculpture is one of traditional art forms of the Indian subcontinent that are made entirely by hand or with some primitive tools from local and natural raw materials without using modern machines. However, these sculptors complain about work-related physical pain, respiratory difficulties, noise-induced hearing difficulties, fatigue, and stress. They are compelled to work long hours because most small enterprises fail to recruit the required workforce. *Objective:* The study's goal is to examine musculoskeletal pain caused by awkward posture and long periods of labor, as well as possible solutions. *Methods:* This study took place in Ghurni, Krishnanagar; district Nadia, in West Bengal. A total of 50 sculptors and 30 non-sculptors of similar socio-economic backgrounds participated in this study. The modified nordic musculoskeletal disorder and the Oswestry low back pain disability questionnaire were used to collect the data. Student t-test was employed for statistical processing. *Results:* Analysis revealed that sculptors suffered mostly from musculoskeletal disorders. The sculptors raised maximum complaints about the pain from the shoulder and lower back. *Conclusion:* Based on the investigation and complaints, work posture and workstation modification is required. The design of a newly developed ergonomic workstation and its usability is proposed for review.

Keywords: Awkward posture, Musculoskeletal disorders, Occupational health, Sculpture, Work stressors.

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INTRODUCTION

The sculpture is the branch of visualized arts that operates in three dimensions. Indian sculpture was consistently influenced by human forms that were idolized to instruct people in the truths of all religions. Artisans belong from the informal sector are subjected to many work-related health problems. As they are from an unorganized sector, they are not supported by any occupational health and safety program. Sculptors perform their tasks without safety precautions and without any prior knowledge about workplace safety thus face work-related injuries.[1] Workers engaged in producing clay dolls belong from a very poor family. They work for more than 8 hours, so they face work-related musculoskeletal disorders.[2] MSD among sculptors causes serious and common health injurious problem in India. Work-related musculoskeletal disorders (WMSDs) have developed as a significant health problem among workers in manufacturing and technologically developing countries.[22] WMSDs are considered for one of the costly occupational disorders because of its extensive impact on the health of worker and his productivity at work. MSDs also caused a significant occupational problem of workers among Arabic Calligraphers in Saudi Arabia.[3] Handicraft and handloom manufacturing units are most frequently found to be an occupation where WMSDs are a big threat to workers.[4,5] Welders were shown to have a higher risk of acquiring WMSDs based on results from the rapid upper limb assessment (RULA) and rapid entire body assessment (REBA), and their working postures must be adjusted right away to lower that risk.[6] Use of tools and equipment, working environments and individual risk factors are apparently most important factors to avoid risk in workstations.[7,8] Studies articulated musculoskeletal problems of the workers identified in unorganized job sectors viz., goldsmiths, sal-leaf plate makers pottery, conch shell workers, brick field, carving, metal related craft work, carving on woods and other various work.[9-12] A study on Thai handicraft workers, showed the majority of the workers complained musculoskeletal symptom in one of the body part, which includes hands and legs (57 and 44%), back area (51%) during one year job duration.[13] Numerous occupational characteristics have been linked to

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pain or discomfort, including repeated tasks, uncomfortable postures, and static positions.[14] In addition, increased physical demands, poor posture, and insufficient recovery time are the main causes of lower back discomfort.[15,16]

This study focuses on several dimensions of workplace pressures and investigates their relationship with the prevalence of MSDS among sculptors. It also offers some preventative solutions by creating an innovative tool for their intended usage at work.

Material and Methods

Subjects

This study was performed in Krishnanagar (Ghurni) and some areas of Kalyani in Nadia district, West Bengal, India. In this unorganized sector, working period is divided into two forenoon sessions (8:00 am to 2:00 pm) and afternoon sessions (4.00 pm to night) with a lunch break of 2 hours. They work for all days of a week.

After the approval from the Departmental Research Committee, sculptors and their close relatives and family members who are not involved in the sculpting were approached from March to June of 2019. Among them family members and native relative, who are not involved in sculpting, are selected as controls. Total 80 male volunteers agreed to participate in the study; out of them, 50 were sculptors with more than 2 years of experience in clay doll making and 30 were non-sculptors not involved in making clay doll. All the volunteers were from comparable socio-economic backgrounds. All the participants confirmed that they have no physical abnormalities and are not suffering from life-threatening or infectious diseases.

Demographic and Physiological variables

After receiving their consent, physical characteristics, such as body weight, height of volunteers, were measured and BMI was calculated. The applied questionnaire was based on the modified standardized nordic questionnaire.[17] This questionnaire included questions about pain or discomfort in different parts of the body. Respondents were asked if they had any musculoskeletal trouble. Owestry low back pain disability questionnaire was used to collect information about discomforts in lower body parts.[18]

Body Part Discomfort (BPD) scale rating– discomforts in different body parts, if any, were collected from the responses of sculptors working. Sculptors involved in work and non-sculptors were evaluated for degree of discomfort/pain with the help of the BPD scale.[19]

Analysis of the working posture – to study the working postures, OWAS (Ovako Working Posture Assessment System) method and REBA (Rapid Entire Body Assessment) were used to search for the postural stress of the workers with the help of stick diagrams prepared for their postures.[20, 21]

Statistical Analysis

Collected data were grouped as values for sculptors and non-sculptors. The comparison between the groups were done by student t-test and statistical significance was considered with $p<0.05$.

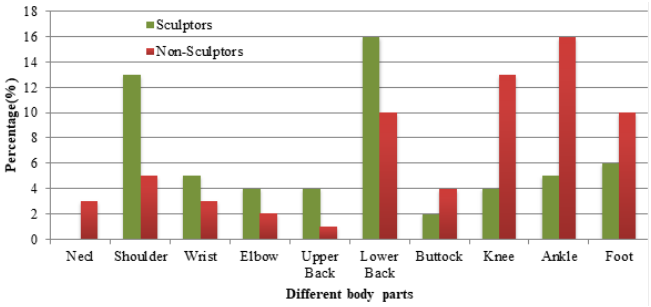


Figure 1: Intergroup comparison of pain prevalence at different body parts among the participants of two groups. Data presented as a percentage of response

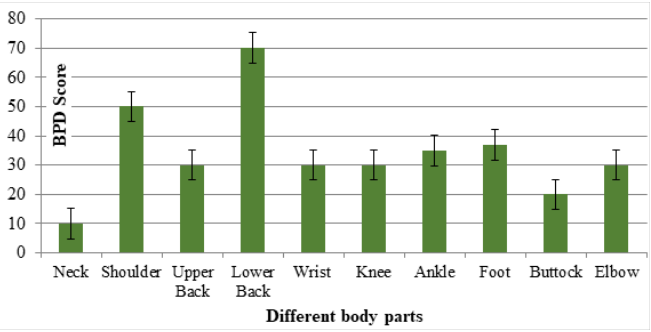


Figure 2: Comparison of BPD Scale of pain or discomfort felt by the participating sculptors.

Results

The population analysis data of participants are presented in Table 1. Socio-demographic characteristics show that most of the workers are married. Control workers have higher working experience than the exposed group.

Table 2 represents physical factors of the volunteers. From these variables, it was observed that most workers are in normal BMI range. Normal/healthy BMI value ranges within 18.5 to 24.9. Though the weight of the non-sculpture participants significantly varied, BMI values did not differ significantly ($p = 0.0809$).

The reported musculoskeletal symptoms in the different body regions of participants in last 12 months prior to the study are presented in Figure 1. This study observed that the pain mostly felt by the workers are different in both groups. In sculptors, pain is mostly felt in the shoulder, low back and in case of non-sculptors, pain mostly felt in knee, ankle and foot.

The pain/discomfort of different body parts felt from different activities was calculated by BPD scoring scale and represented in Figure 2. Lower back, shoulder, foot, ankle, upper back, and elbow are mostly complained body parts found among the exposed participants, that is the intensity of pain is higher than other body parts.

Different working phases and postures of sculpture workers were analyzed by posture analysis tools along with the action category that was presented in Table 3. According to

Table 1: Comparison of demographic features of the study participants.

Characteristics		*Sculptors (N= 50)*	*Non-sculptors (N=30)*
Years (Mean ± SD)	Age	43.63 ± 11.25	42.25 ± 7.48
	Earning experience	20.40 ±11.29	30.30 ± 9.25
Marital status	Married	36 (90%)	28 (95%)
	Unmarried	4 (10%)	2 (5%)
Smoking status	Smoker	15 (37%)	9 (30%)
	Non-smoker	25 (63%)	21 (70%)

Table 2: Comparisons of physical variables of the study participants.

Physical variables	*Sculptors (N= 50)*	*Non-sculptors (N=30)*
Height (cm)	159.80 ± 5.70 (143.0 – 168.0)	161.45 ± 4.25 (154.0 – 170.0)
Weight (kg)	60.23 ± 7.33 (47.0 – 74.0)	64.10 ± 8.80* (53.0 – 87.0)
BMI (kg/m^2)	23.59 ± 2.62 (17.7 – 28.2)	24.68 ± 2.73 (21.5 – 28.4)

Data presented as Mean ± Standard Deviation with range in parentheses. * indicates $p < 0.05$.

the postural analysis, the body areas were more likely to be harmed by difficult bending.

Discussion

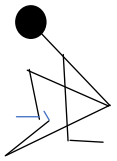
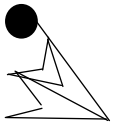
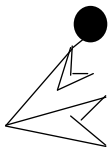
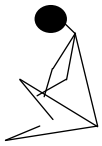
In this study, the evaluation of work-related MSDs of sculptors has been performed. Both group of participants belong to the same social background but perform different tasks. In table 1 and Table 2, socio-demographic variables and physiological variables have been represented.

Figure 1 shows pain prevalence at different body parts of exposed and control participants. Their typical working posture forces them to work in an awkward posture for a long duration regularly, which may cause musculoskeletal symptoms among handicraft workers.[4] Since the control participants are not engaged in making clay dolls but rather assist in sculpting accessories, their excessive ankle and knee pain may be attributed to their domestic chores.

The severity of pain or discomfort of different body areas from different activities was measured using the BPD scale in figure 2. Lower back, shoulder, foot, ankle, upper back, and elbow are mostly complained body parts found among the exposed participants, indicating the prior chance of developing musculoskeletal injuries. This may be due to their working posture lacking a proper operating surface to work on.

In table 3, analysis of awkward posture is performed to analyse whether any action is required. OWAS and REBA was used MSD tool for analysis. In REBA score, the action category of 4-7 indicates the working posture is in medium risk. Further investigation may be needed as change soon. Medium risk in REBA scores has been observed by posture analysis. In case of

Table 3: Postural analysis on the basis of REBA and OWAS score of Sculptors

Stick diagram of working posture	*Scores*	*Level of risk*	*Action*
	REBA Score: 7 OWAS Score: 2	Medium risk Some harmful	Corrective actions required
	REBA Score: 4 OWAS Score: 2	Medium risk Some harmful	Corrective actions required
	REBA Score: 6 OWAS Score: 2	Medium risk Some harmful	Corrective actions required
	REBA Score: 3 OWAS Score: 2	Low risk Some harmful	Corrective actions required
	REBA Score: 3 OWAS Score: 2	Low risk Some harmful	Corrective actions required
	REBA Score: 7 OWAS Score: 2	Medium risk Some harmful	Corrective actions required
	REBA Score: 7 OWAS Score: 2	Medium risk Some harmful	Corrective actions required

OWAS score, the action category of 2 indicates posture with a few harmful effect on the musculoskeletal system-correlation actions should be done as earliest. Most of them are found in this action category, which show change in working posture, and are required in the near future.

Intervention is a platform for designed and tested method or equipment to gain insight into the problem and ultimately solve it. It acts as an intervening outcome, especially of a condition. In this case, workers required a properly designed working tool that fits their working method and restricts awkward posture.

Ergonomics intervention is required to improve the quality of life of sculptors (Figure 3). A table is designed ergonomically

Figure 3: Sculptors using ergonomically designed table prototype for clay doll making

to place their product on this table during the time of work. The best part of this table is it can be rotated the surface of the table, which provide more ease to their working pattern and there will be comparatively less problem in holding a product in over time. The table's length is adjusted for working in a "comfort zone". It is made for the purpose of "easy to use".

Conclusion

Present study reveals that the clay doll making sculptors, who have inherited this occupation, most of the time they have to work in awkward sitting posture. Different activities of the workers, working in the unorganized sector, were repetitive. They spend more than 8 hours in their workplaces with different types of working postures. After a long lunch break, they again engage in work for another long duration till evening, which mostly exceeds 8 hours. They have to work in a leaning posture in front of the product to give it a better shape, which causes discomfort and pain. They bend their neck downwards, which is a very clumsy posture for working. This results muscular problems in neck and shoulder areas mostly. They also worked with holding the product in their hands for long time to have a close view for a flawless finish of the dolls. Lower back pain is very common due to working in a typical sitting posture. Thus, it is essential to overcome those workplace problems and modify some non-ergonomic activities during work. Some small improvisations in working conditions, implements, tools design or working methods can potentially lead to large benefits. Sculpting is a strenuous job, where different people worked together daily with multiple problems. Thus, requires a multivariate approach to infuse life and sustain its development.

Accordingly, the following recommendations are suggested: Ergonomic interventions to meliorate the existing sculpture workstation, aiming at improving the operational easiness and occupational wellbeing of the sculptors. Regular breaks in between work hours such as 2 hours of continuous work with 15 minutes of break in between, may reduce the length of duration and intensity of their musculoskeletal stress.

Conflict of Interest

The authors declare that there is no conflict of interest.

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