Evaluation of Risk Factors Causing Musculoskeletal Disorders Using QEC Method in a Furniture Producing Unite

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Abstract
The musculoskeletal disorders cover a large percent of occupational diseases; therefore, in order to protect workers from such disorders, there is a need to evaluate workers positions at work in different industries. In a major furniture manufacture located in Tehran, 500 workers were examined. These workers were divided into fourteen working groups, including production lines of water-heater, air condition, electromotor production line, dunnage making hall, plastic hall, smithery, restaurant, store, engineers and supervisors, facilities, transportation, assembly of absorptive refrigerator and drivers. The results from Nordic Questionnaire and performing the evaluation method showed that, there was a significant relevance between outbreak of back pain and workgroups (P=0.005) and between the outbreak of pain in neck and workgroup as well. Between other parts of the body and workgroup no significant relevance observed. Among workgroups, there was a significant relevance between the water-heater production line (P<0.005) and pain in the back, and there was also a significant relevance among the work in air–conditioning production line and the plastic injection (P=0.002), causing pain in the neck. The results from Quick Exposure Check (QEC) in one hundred working posture have shown that 10% of them fall into first and second level and 90% of them were categorized in third and forth levels.

Keywords: Work-related musculoskeletal disorders, Furniture producing workers, QEC method, Iran

Introduction
Skeletal disorders—work related muscular are appeared usually due to the long term stress or repetition in soft tissue of the man such as nerves, tendons and the joints. Its side effects at first were described in 19th and 20th century. Most countries incurred an epidemic disorder, skeletal disorders, and the repetition movements (1). In Japan, more often among the workers, increasing in musculoskeletal disorders between years 1960–1980(1) was engaged typing as an operator and assembly lines and most of them felt uncomfortable in hand, arm, and shoulder in 1980. In Scottish countries these problems were revealed and most part of it were related to the back pain among white collar workers, the discomforts of wrist, the shoulder, with Nordic process-factors in creating pain in neck, and arm leading to a careful survey (2). Musculoskeletal disorders among 1980–1986 were increased in the United States and the number of sufferers were increased from 50000 people in 1985 to 332000 in 1994 (3). Naturally, the outcome of the disease and musculoskeletal disorders at working-place, its costs and compensation were paid by the owners of the industries and governmental centers (1). With regard to the above cases, the furniture industry is a part of semi heavy industries and often worker's role in production process is unavoidable. Therefore, the hand operations such as moving, pulling, and pressing pieces and working in a static form causes musculoskeletal disorders mainly in back, shoulder, arm, wrist, and the neck. This study was carried out as a last method of evaluation called Quick Exposure Check in the Iranian industries.

Aims:
Evaluation of,
-musculoskeletal disorders in worker's back,
-incidence of the musculoskeletal disorders in
shoulder/arm, wrist, and neck,
-risk factors related to the musculoskeletal dis-
orders in back shoulder/arm, wrist, and neck,
-risk factors related to the unergonomics job,
Preference classification of different sections of
production lines based on obtained results.

Materials and Methods
In order to perform this research evaluation
tools of the work-condition, method of QEC
and Nordic Questionnaire regarding the study
of the incidence of musculoskeletal disorders
were used (5). Two hundred and twenty Nordic
Questionnaire were completed including 50%
of workers production lines. Also, for all avail-
able workplaces in production lines, 100 work-
places of the physical exercises and the ob-
tained results were analyzed using QEC soft-
ware and finally the gained information were
processed, applying the SPSS/9 software. To
evaluate the musculoskeletal disorders resulting
from working posture, methods of the observa-
tion, OWAS, REBA, PLIBLE, the observation
method using video computer URBAN, VIRA,
ROTA, HARBO, direct method, the reporting
method, and physiological approach could be
pointed out (1).

**QEC method**
A quick, comprehensive, and
practical method for the musculoskeletal disor-
ders evaluation was developed by Prof. P.
Buckle and Dr G. Li in 1999 in the Research
Center and Robens Center, Surrey University,
in which, action level of the method was pro-
posed by Dr Li colleagues in 2003 (6). This tool
evaluates some parts of the body, including the
back, shoulder/arm, hand-wrist, neck, and re-
garding to the observant encounter, the type of
the work, and the employed answer, factors are
determined and it independently goes to the
scores tables (3): The maximum weight of the
moving pieces, the duration of the time of do-
ing a work, the maximum applied force by one
or two hands, bending or moving mentioned
organs mentioned, conducting repetitious move-
ment, doing a work in a static or dynamic form,
the existing vibration and a good eyesight in
doing the work. One of the special characteris-
tic is evaluation method of attention to the psy-
chological aspect or stress, resulted from work. Fi-
ally the whole points gained from each posture
are independently calculated with the following
formula exposure level for action level and er-
gonomic intervention (4): $E\% = \left(\frac{E}{E_{\text{max}}}\right) 100$
Where E is referred to as exposure. Action level
is divided into four levels, in which, the third
and the fourth levels required to the amendment
measures considering that, at fourth level these
measures must be immediately performed (5).

**Nordic Questionnaire** Since 1987 Nordic
Questionnaire was established by Korina and
his colleagues in Occupational Health institutes
of Scandinavian countries aiming to the deter-
mination of the incidence of musculoskeletal
disorders resulted from the work (6).

Results
Results obtained from Nordic Questionnaire are
shown in Table 1.

**Table 1:** The incidence of the musculoskeletal disorders

<table>
<thead>
<tr>
<th>Body part</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>24%</td>
</tr>
<tr>
<td>Arm</td>
<td>17%</td>
</tr>
<tr>
<td>Leg</td>
<td>20%</td>
</tr>
<tr>
<td>Knee</td>
<td>48%</td>
</tr>
<tr>
<td>Up-back</td>
<td>9%</td>
</tr>
<tr>
<td>Wrist</td>
<td>23%</td>
</tr>
<tr>
<td>Back</td>
<td>50%</td>
</tr>
</tbody>
</table>

As it can be seen, the most incidences were
shown in the back with 50% and 24% in the
neck. The pain incidence was seen in the back,
leg and the knee in the water-heater production
line, respectively (1-A to 28-A Table 2), and
the pain incidence in the neck was observed in
the air-condition production line (1-B to 30-B).
Those who were involved guard section, engi-
eering unit, serial production, water-heater
assembly, big press process, plastic injection
and laboratories, have shown a low incidence in
neck and shoulder/arm. Results from perform-
ance of the method QEC evaluation in one hundred work posture have shown the following arrangements: one percent of workgroup of the production unit at first level of action level, 9% at the second level, 55% at the third level and 35% at fourth level. Based on fourth posture, jobs such as A, C, 1-G, 2-J, 1-K, 1, 2-L with 55% of the whole workgroup were placed at the third level of reformed performance. Jobs such as A, B, C, 1-F, 2-G, 1-H, 2-K, 35% of the whole workgroup were placed at the fourth level of the reformed performance. Jobs such as A-26, B, and C, 1-I, and 1-J, 9% were placed at the second action level (Table 2). The simultaneous survey of obtained results from the method of QEC and Nordic Questionnaire have shown that, there is a significant relevance between the incidence of the back pain and the workgroup (P=0.005). Also, there is a significant relevance between the incidence in the neck of different workgroup (P=0.005). These results indicate that, work at the above mentioned workstation causes musculoskeletal disorders in the back and the neck. Regarding to the incidence of the disorders in other parts of the body and workgroup no significant relevance was observed. With the reconsideration among workgroups, it was observed that, the work in water–heater production line has a significant relevance with back pain (P<0.005). Working the air-condition production line and plastic injection has a significant relevance with pain in the neck (P=0.002).

Table 2: List of tasks used during assessment

<table>
<thead>
<tr>
<th>Disc press</th>
<th>Wire curl</th>
<th>Fixing disc</th>
<th>Fixing head</th>
<th>Fixing of mini-pipe</th>
<th>Wire control</th>
<th>Polyester</th>
<th>Holing of cable</th>
<th>Fixing of center pipe</th>
<th>Fixing of pine</th>
<th>Abrasive</th>
<th>Electric test</th>
<th>Fan cutting</th>
<th>Rotor abrasive</th>
<th>Auto mechanic</th>
<th>Oil changing</th>
<th>Refrigerator</th>
<th>Drivers</th>
<th>Machine mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-C</td>
<td>4-C</td>
<td>5-C</td>
<td>6-C</td>
<td>7-C</td>
<td>9-C</td>
<td>10-C</td>
<td>11-C</td>
<td>12-C</td>
<td>13-C</td>
<td>14-C</td>
<td>15-C</td>
<td>16-C</td>
<td>17-C</td>
<td>1-L</td>
<td>2-L</td>
<td>1-M</td>
<td>1-N</td>
<td>2-K</td>
</tr>
</tbody>
</table>

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Discussion

Study of the psychological stress resulted from work in one hundred work stations by the method of QEC showed that, the most stress from the gained points is equivalent to 34 (maximum possible points) belong to electrical facilities unit. Jobs such as A, B, C, 1-D and 1-N by gaining points between 14 to 21 have relatively more psychological stress (Table 2) (7). The following recommendations are suggested:

-Since most work in this factory have been allocated based on the physical ability to the young individuals, (for example in most work stations in water–heater production line has been engaged to the young individuals), the role of anthropometry principle in designing tools and work station could be prevented from the musculoskeletal disorders (6).

- With rotating the jobs, workers who are doing the repetitious works in a static positions have an opportunity in making movements and in the gathering of lactic acid too much in muscular and tiredness could be prevented (6).

- By designing the chair, the work–table, the proportion of the work type to its height, and the ergonomic intervention in some jobs embarking on transportation by hand, will considerably be reduced the incidence of musculoskeletal disorders (8).

- The rectification of the work–shift program at the factory and a proper planning according to the human physiology system (in a weekly work–shift, i.e. morning, evening, and night respectively) will effectively be deducted in mental and physiological stress resulted from the works (8).

- A periodic educational program as well as daily body practice can play a main role in reducing the musculoskeletal disorders resulted from the work position and postures.

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References

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