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MEASUREMENT OF PAIN AMONG ELECTRICIANS WITH NECK DYSFUNCTION

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ABSTRACT. The aim of the study was to develop a pain measurement instrument in Swedish intended for use in epidemiological surveys, and to report the pain assessments of individuals in a working population. The focus was on somato-sensory description in relation to work performance. The material comprised 22 randomly selected electricians attending health check-ups, and reporting neck pain during the past week. The pain estimations were made in oral interviews using a specially developed questionnaire. Neck extension and hands above shoulder height caused increased neck pain in all the subjects. The quantitative assessments of present pain showed a limited intensity. To describe the pain quality a wide spectrum of words was used as pain descriptors, but five adjectives were preferred. The more the pain was spread on the pain drawing, the more differentiated was the assessment of its quality. The results concluded that the pain assessment instrument might be useful in epidemiological investigations of musculoskeletal neck dysfunctions.

Key words: neck pain, visual analogue scale, verbal pain quality, pain assessment, work postures.

INTRODUCTION

Pain cannot be directly observed but the experience can be subjectively scaled by individuals in one or several dimensions. The number of conceptual models and theories of human pain attest to the complexity of pain and pain experience in man. Knowledge in this field is hard to survey and it is not always possible to compare results from investigations because of the lack of consensus among studies and the differences in pain measurement techniques.

Using a single dimension in measurement, a category scale (19), a visual analogue scale (VAS) (20) or a numerical rating scale is frequently adopted. Beecher (2, 3) proposed that measuring the duration and intensity of pain was not enough but that the reaction component of pain should also be considered so as to estimate not only the quantitative but also the qualitative and functional aspects. The subjective data obtained would make it possible to show a broad picture of the patient or a group of patients in pain. Measurement of these several dimensions requires more than one scale, or a multidimensional questionnaire such as the McGill Pain Questionnaire (19) which contains, besides category scales, words to be chosen as pain descriptors, questions about associated symptoms, and a pain drawing.

There are considerable numbers of self-report measurement tools for the assessment of clinical pain (4, 6, 8, 9, 13, 17, 19). They frequently involve verbal pain description, scaling of pain intensity, questionnaires and pain drawings.

Few of the many associated studies have focused on pain and assessment of work-related function. Work simulation programmes in the rehabilitation of patients are available but there is a lack of self-reported measurements of pain with reference to work performance.

The aim of the present study was to develop a multidimensional functional pain measurement instrument in Swedish for use in epidemiological surveys, and also to report the quality and quantity of the pain assessments of individuals in a working population, who reported ongoing neck pain.

We asked ourselves the following questions:

1. How are the sensory qualities of pain in the upper part of the body described by individuals in an occupational group experiencing ongoing pain in the neck?

2. How is the quantity of pain in the upper part of the body assessed by individuals in an occupational group with ongoing neck pain?

3. How is the pain distributed and how do the qualitative and quantitative descriptions and measurements of pain relate to pain drawings?

4. What associated symptoms do the individuals report?

5. To what extent is the dysfunction of the neck related to different postures and movements of the upper part of the body and how is the relation between the dysfunction and the working situation?

6. Do the VAS assessments yield reliable and consistent values?

MATERIAL AND METHODS

Subjects

Twenty-two male electricians were randomly chosen out of a population of 3,144 electricians attending health check-ups at the Construction Industry's Organization for Work Environment, Safety and Health (Bygghälsan) in Stockholm, Sweden. Everyone who visited the clinic on 12 different days within a month and fulfilled the criteria were included in the study. A total of 87 men underwent health check-ups during these 12 days and 22 fulfilled the criteria.

The criteria for inclusion were i) at least one year of work as an electrician after becoming qualified, ii) having reported pain in the neck during the past week using the standardized Nordic questionnaire for the analysis of musculoskeletal symptoms (10) before the health check performance, and iii) having Swedish as the mother tongue. All individuals who were asked and fulfilled the criteria volunteered for the study.

The subjects were aged from 18 to 59 years (mean 36 years, SD = 13 years) and they reported a history of neck pain of 0 to 17 years (mean 4.4 years, SD = 4.9 years). Twenty-one had had their neck pain for at least six months and one for a few days. Eighteen (82%) said they usually had periodic pain and were at the moment in a period of such pain. The remaining four had continuous pain and were never free from pain.

Four of the subjects had attended physiotherapeutic treatment during the last year because of their neck pain. The remaining 18 (82%) had not received any kind of treatment due to neck problems during the past year. None of the subjects were on sick-leave at the time of the interview.

Assessment instrument

A questionnaire in Swedish was designed for individuals with neck dysfunction. The questionnaire included general questions on personal data, associated symptoms, medication, recent treatment of dysfunction of the upper extremity, and work situation.

The idea of the MacGill Pain Questionnaire (17) was adopted in the questionnaire regarding verbal sensory pain descriptions, present pain intensity, worst pain intensity and least pain intensity. However, the quantitative assessments for each of these variables were estimated on 100-millimetre visual analogue scales (VAS) anchored by *no pain* and *worst imaginable pain*, respectively. In the original MacGill Pain Questionnaire, pain assessments used category scales.

The words describing the sensory dimensions of pain were divided into ten categories comprising 38 Swedish adjectives for sensory pain description. Each category represented a particular type of pain (Table I): warm temperature, cold temperature, punctuate pressure, paraesthesia, interior pressure, aching-like, incisive pressure, constrictive pressure, rhythmic temporal, irregular temporal. The answers were either oral or given by the markings on the VAS and shadings on the pain drawings. The subjects themselves read all the sensory pain descriptors. Each subject had to pick at least one of the pain groups, as they had already stated neck pain; and at the most all ten. They were only allowed to choose one word from each pain group chosen. To each category of pain descriptors a VAS was connected for quantitative assessments of the intensity of pain that was ascribed to each pain group.

VAS ratings were also made for present pain, worst pain and least pain.

Information on the spatial distribution of the neck pain was obtained by using pain drawings. On an outline human figure the subjects shaded the areas where they had pain. To analyse the pain drawing, a transparent overlay of the body outline, divided into thirteen areas, was used (Fig. 1).

To obtain an idea of the reproducibility of the questionnaire and especially on the VAS ratings and the pain drawing these items were sent to ten randomly selected subjects, of the group studied, after ten to 20 days. Nine of the ten subjects answered but in two cases the information was incomplete and those two forms could only be analysed partially.

Statistical analysis

Pearson's correlation coefficient was used to analyse the correlation between the VAS ratings within the questionnaire. Pearson's correlation coefficient was also used on the test and retest of the number of pain groups chosen and the number of marked areas of pain in the pain drawing.

The degree of agreement between test and retest regarding the choice of pain groups and the number of marked areas in the pain drawing was estimated by the percentage of full agreement.

RESULTS

The mean of the number of pain groups chosen was 4. The most selected group was number 5, containing the words for interior pressure (Table I). It was chosen by 16 (73%) of the subjects (Fig. 2). The second most frequently chosen group was number 8, comprising words for constrictive pressure (Table I) selected by 14 (64%) of the subjects (Fig. 2). Group 6, containing words for ache-like sensations (Table I) was chosen by 13 subjects (59%) (Fig. 2).

Pain group 2, containing words for cold temperature (Table I), was the least chosen group, selected by two subjects (Fig. 1). Pain group 7, with words for incisive pressure (Table I) was the second least chosen, selected by three subjects (Fig. 2).

Fig. 2 shows the frequency of the single words chosen. The most chosen word was tense reported by 13 (59%) followed by numb chosen by ten (45%) and thirdly aching picked by seven (32%) (see also

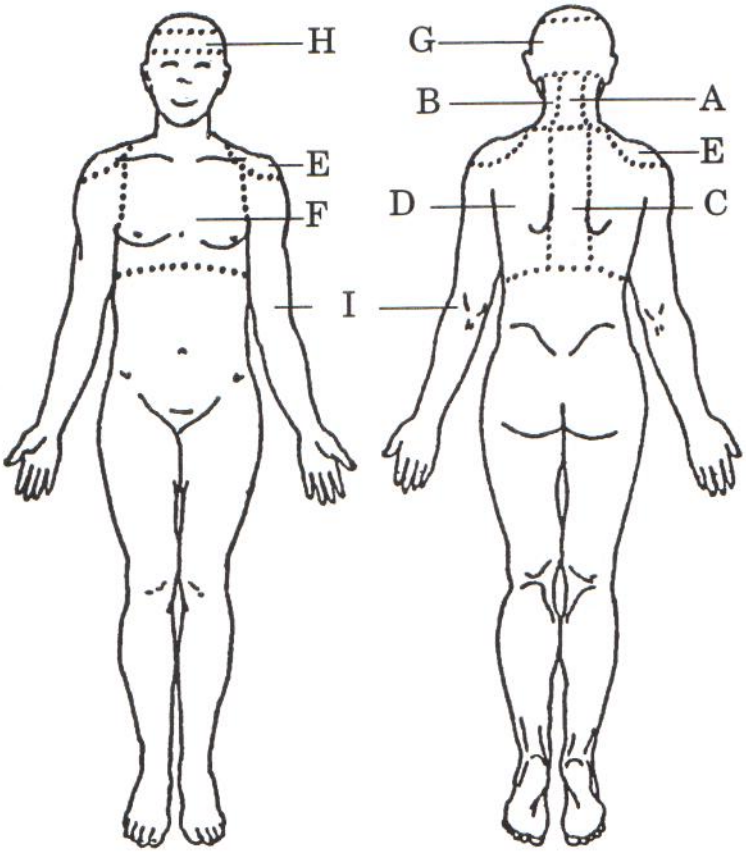

Fig. 1. Outline of human body with dotted lines marking the different areas for the analysis of the pain drawings.

Table I). The words hot, boiling, cool, vibrating, tingling, insensitive, dull, drilling, pulling, pinching, and cutting were not chosen at all.

The degree of agreement between test and retest regarding choice of pain groups was 77% of full agreement. There was a correlation of 0.8 between the mean of the VAS ratings of the assessment of pain in chosen pain groups on the two occasions ($n = 7$).

The VAS assessments of "worst pain" on the test occasion ranged from 12 mm to 87 mm, with a mean rating of 56 mm (SD 16 mm). At the time of completing the questionnaire one subject rated his pain as "worst", the remaining 21 subjects rated less pain than as worst on this occasion.

"Worst pain" intensity had a correlation of 0.5 between the test and the retest occasions ($n = 9$).

There was a correlation of 0.8 between the variable "worst pain" rated on the VAS line and the mean of the VAS ratings of the reported pain groups ($n = 22$).

"Least pain", ranged from 0 mm to 10 mm. Fifteen (68%) estimated "least pain" to be zero while 7 (32%) rated that they were never free from pain. The test retest correlation for this variable was of 0.6 ($n = 9$).

"Present pain" was estimated between 0 and 40 mm, mean 13 mm (SD 11.5 mm) ($n = 22$). Four subjects rated no present pain (i.e. at the very left end of the VAS) at the time of completing the questionnaire.

The number of painful areas shaded on the pain drawings ranged from 2 to 7, with a mean of 4.3. Eighteen (82%) of the subjects stated pain in the lateral neck. Twelve (55%) indicated pain on both sides of the neck and 5 (23%) on the right part of the lateral neck. Nine (41%) reported pain in the medial neck but always in combination with pain in other parts of the upper part of the body. Eight (36%) shaded the medial as well as the lateral aspect of the neck. Only one subject did not report pain in the cervical area but in the thoracic back, the shoulder, and both arms. Twelve (55%) included the

Table I. *The ten pain groups and the pain descriptors included in the questionnaire*

1. *Warm temperature* warm hot burning boiling	2. *Cold temperature* cool cold freezing
3. *Punctuate pressure* vibrating tingling pricking	4. *Paraesthesia* numb insensitive
5. *Interior pressure* tense inflamed throbbing with pain	6. *Aching-like* sore dull heavy tingling chafing aching
7. *Incisive pressure* piercing sharp penetrating drilling	8. *Constrictive pressure* tight stiff contracted spasmodic
9. *Rhythmic temporal* pulling pumping pulsating throbbing	10. *Irregular temporal* pinching shooting stabbing cutting splitting

shoulders, and seven (32%) the arms in the pain drawing (Fig. 1).

There was a correlation of 0.8 between the number of pain groups chosen in the questionnaire and the number of areas shaded in the pain drawing ($n = 22$). The fewer pain groups chosen, the fewer shaded areas in the pain drawing and vice versa.

The test and retest of the use of the pain drawing was analysed as the number of areas shaded on the two occasions. The number of areas had a correlation of 0.8 ($n = 9$).

For each subject it is possible to present the individual combination of pain groups, adjectives chosen, and the pain drawing, as vizualised in Fig. 3.

Among associated symptoms, headache was reported by seven (32%) subjects and flickering before the eyes by six (27%). Pain in the back of the head was reported by four (20%) individuals also stating frequent headache.

Nineteen (86%) stated difficulties in doing their work due to their neck problems. Four of these (20%) had been able to change their working routines or working situation.

Eighteen (82%) reported increasing neck pain when working with their hands above shoulder height. Fourteen (64%) reported increasing pain when bending the head backwards or keeping the head bent back.

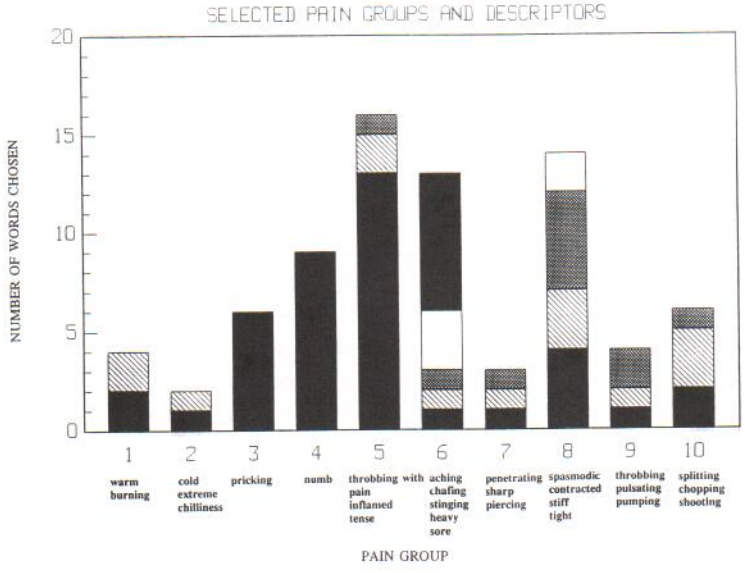

Fig. 2. Selection of pain groups and pain descriptors. Each subject had to select at least one pain group and one word, and at the most all ten pain groups and one word in each. One pain descriptor could be chosen in each pain group. The lowest part of each staple corresponds to the lowest written word below the x-axis, etc.

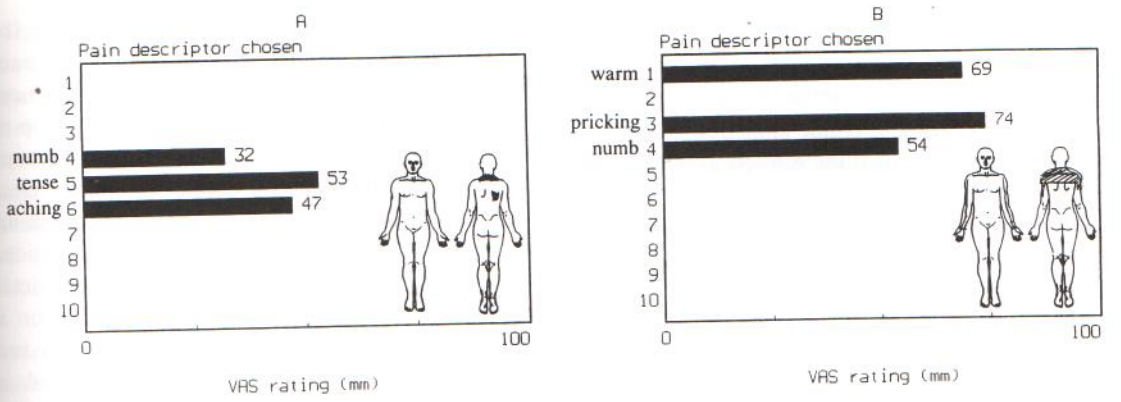

Fig. 3. Examples of the pain profiles of two subjects. Subject A was 26 years and had had continuous neck pain for one year. Neck extension, flexion and carrying burdens increased his pain. Subject B was 47 years and had had 10 years of periodic neck pain. Hands above shoulders increased his pain. For the pain groups, see Table I.

Thirteen (59%) reported more pain while keeping their hands above shoulder height and their head extended. Nine subjects (41%) reported neck pain when the head was bent forward but three (14%) reported that bending the neck forward decreased their neck pain. Seven (32%) had more pain when carrying burdens and nine (41%) when rotating the head to the side or keeping the head rotated to the side (Table II).

Table II. *Work postures and their influence on each subject's neck dysfunction*
+ is for increasing the pain and, – is for decreasing the pain. Each letter represents one position, and each number one subject.





	carry burdens A	neck flexion B	neck extension C	neck rotation D	arms above shoulder height F
1		+	+		+
2		+		+	+
3		+			+
4		+	+		+
5			+		+
6		+	+	+	+
7			+		+
8		+	+		+
9	+	+	+	+	+
10				+	
11	+	–	+		+
12	+	+			+
13			+		+
14				+	
15	+				
16		+			+
17		–	+		
18	+	–	+	+	+
19	+			+	+
20			+		+
21			+	+	+
22	+		+	+	+

DISCUSSION

Subjects

The present subjects were of the same gender and had the same language and ethnic affiliation. The group was homogeneous in that the subjects all belonged to the same occupational group and were at a similar educational level. It has been shown that differences in pain tolerance and pain description exist between different ethnic groups (24,25). The present investigation tried to conceptualize solely the somato-sensory pain experience deriving from reported musculoskeletal dysfunction in the neck. Choosing a homogeneous study population probably avoided bias from cultural, ethnic or social differences in pain reporting and focused on the plain sensory description of pain.

Variability in pain description among individuals also depends on psychological, physiological and biochemical mechanisms (5). The pain description would probably not be identical even in individuals with exactly the same anatomical structures involved in a dysfunction.

For the group investigated as well as for other individuals in physically demanding occupations the exposure to biomechanical loading has to be considered in pain description analysis.

Electrician's work postures frequently involve keeping the hands above the shoulders for as much as one third of the working hours (1,22). The majority of the subjects in the present study estimated that this posture increased their neck pain. This is not surprising as the posture is used a great deal among these subjects and puts a high biomechanical load on the neck, shoulders, arms and upper part of the back.

None of the subjects was on sick leave in spite of ongoing pain from the neck. This presumably further reduced the interpersonal variation in the group and offered the possibility to focus on the sensory pain description and the work related function. In a population with individuals on sick leave there would probably exist more pain behavioural problems to be considered in the pain description and measurement techniques.

Pain quality

No previous studies have concerned a semantic analysis of pain description in subjects with reported pain in the neck, shoulders and arms. Investigations of verbal pain description have, however, been performed with patients with low back pain (7, 11, 14, 21).

The present study shows that individuals describe pain from the neck by a wide spectrum of pain descriptors. Five adjectives appeared to be the most preferred for describing the neck pain in this group of subjects: pricking, numb, tense, aching, and contracted. The pain quality grouping among the electricians seemed mainly to be an aching pain with an interior or constrictive pressure as a pain sensation. This would confirm the pain as being musculoskeletal as this pain is considered to be an aching or a constrictive pain, indicating that the muscles are contracted in cramp (12). Melzack presented a description of musculoskeletal pain as aching, tender and tiring-exhausting (18).

Pain quantity

All the quantitative variables were rated with VAS scales to obtain the intensity of the pain. Several VAS scales were used to make the assessments of pain multidimensional and thorough.

As to the relatively low correlations of the test-retest of worst pain and least pain and the higher correlations of the multiple VAS ratings of the adjectives chosen, the latter seems to be preferred in pain measuring. Pain rating and pain experience might be too complex to be reported in summary and there could be a risk of an oversimplification of the pain measurement if too few VAS scales are used (23). In addition, variability in VAS assessments may occur because it is difficult to mark the same spot a second time on the ungraded VAS line (14). It has been concluded that changes in VAS ratings of less than 10 mm were of no clinical value (14). In a study of Carlsson it was suggested that changes more than 6 mm show a true change of the assessment (6).

All individuals rated the present pain on the left part of the VAS, indicating a moderate intensity (< 40 mm). This is in accordance with the fact that all the subjects were working and not on sick leave. A higher average of present pain rating might be obtained among individuals on sick leave due to neck dysfunction.

Pain distribution

The larger the area of the neck pain that was marked, the more pain groups were chosen. This indicates a relationship between the differentiation of pain qualities and the spatial distribution of pain.

The present result from the test and retest of the pain drawing confirms, despite the limited number of subjects, the reproducibility regarding the extent and distribution of pain shown in earlier investigations (15). The pain drawing is, as concluded in other studies (16), a useful fool in epidemiological research. It seems easy to the subjects to understand and to use. The disadvantage is the difficulty in calculating the surface area of the subject's shading on the drawing. In the present study the body was divided into the different areas for analysis of the drawings. This is a crude way of assessing the size of the area in pain, but appropriate for demonstrating the site of the pain.

CONCLUSION

It was concluded that the pain questionnaire could be used to thoroughly measure quality, quantity, and distribution of pain in subjects with pain related to work posture.

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