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A CONTROLLED STUDY OF THE EFFECT OF NECK SCHOOL IN MEDICAL SECRETARIES

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ABSTRACT. The effect of "neck school" on neck and shoulder disorders was studied in medical secretaries. A neck school reinforced with compliance enhancing measures (group B) was compared with a traditional neck school (group A) and a control group (group C). The results show that ergonomical knowledge was good even before the secretaries attended the neck schools and that compliance was significantly higher for group B. When comparisons were made within groups some improvements on neck and shoulder fatigue and pain were noted, particularly for group B. When workload was controlled no significant group differences were found. No differences were noted for range of neck motion, or sickleave in any group. Our conclusion is that neck schools, despite good compliance, appear to be of limited clinical value for prevention of neck and shoulder disorders.

Key words: neck and shoulder disorders, occupational, neck school, compliance.

The increase in musculoskeletal disorders (14, 19, 22) along with the recognition of a multifactorial etiology (2, 3, 15, 21) has caused a shift in interest from the treatment of these disorders towards their prevention (22). One commonly used preventive measure is the back school (25). Although initially directed mainly towards chronic disorders, back schools have become popular tools for secondary prevention (10, 20). Secondary prevention refers to interventions designed to eliminate, reduce, or prevent further development of pain. In addition to back schools, neck schools have recently been introduced. They differ little from back schools, but focus more specifically on problems related to the neck and shoulders.

A back or neck school may be described as an educational package for increasing the participants' knowledge of their back problem and its relationship to environmental and individual factors. With increased knowledge, it is hoped that the patients will modify their personal behaviour and surroundings (e.g. workplace) in order to control, limit, and/or prevent the pain.

The need for evaluation of intervention programmes for work related musculoskeletal disorders is pointed out by Kihlbom (13). Although there is substantial knowledge regarding risk factors for musculoskeletal disorders, it is not possible to predict the outcome of an intervention programme aimed at reducing these factors. This is, according to Kihlbom, due to the multifactorial etiology and the complex interaction of effect modifiers. Consequently, controlled studies using a wide range of outcome variables are called for. The efficacy of back or neck schools is dependent on whether the participants have increased their knowledge and altered their behaviour accordingly. Although attempts have been made to study the effects of back schools, the results are not conclusive (9, 18). One general problem in evaluating back schools is the inadequate attention paid to compliance (9, 11). Knowledge of the patient's compliance is essential when attempting to evaluate the results of any treatment programme (13). This is particularly true when dealing with negative studies, since, when compliance is unknown, it is difficult to judge whether the negative results are due to ineffective treatment or actually reflect lack of treatment caused by noncompliance.

The aim of this investigation was to conduct a controlled study of the effects of neck school as a preventive intervention on neck and shoulder disorders. The study included a wide range of variables to evaluate compliance and outcome.

MATERIAL AND METHOD

Subjects

Seventy-nine medical secretaries currently working at the Medical Center Hospital in Örebro were invited to take part in this study. The group has been described in more depth in a previous study (12). Included were individuals who 1) had

experienced some pain in either the neck or shoulder region during the previous year, 2) estimated their average time spent sitting during working hours to be a minimum of five hours daily, 3) worked at least 30 hours per week and 4) were not presently under, or in need of, medical treatment for their neck and shoulder problems.

Participation in the study was voluntary and the secretaries were informed that those who declined would of course receive adequate treatment. The study was approved by the hospital's Health and Safety Committee as well as its Board of Ethics.

The 79 female secretaries had a mean age of 39.4 years (SD 10.7), and had worked as secretaries for an average of 9.6 (SD 7.3). Seventy-three percent worked full time, i.e. 40 hours per week, while the remaining 27% worked at least 30 hours per week.

During the course of the programme, 3 secretaries went on sick or maternity leave and consequently 76 individuals remained in the study.

Procedure

The subjects were randomly assigned to a control group or one of two intervention groups. Assessments were conducted prior to intervention (pre), after completion of the four-week intervention period (post), and at 6-month follow-up.

Groups

Group A ($n=25$). Subjects in this group attended a 4-hour traditional neck school conducted by a physiotherapist from the hospital's Occupational Health Care Center. The main purpose of the school was to provide the secretaries with knowledge of appropriate measures to prevent work related neck and shoulder pain. Lectures were given twice weekly during working hours and consisted of a series of slides which included anatomy, etiology of musculoskeletal disorders, ergonomy and self-care measures. Part of each lecture was devoted to practical training, e.g. active and stretching exercises for the neck and shoulder muscles along with the practive of muscular relaxation. The importance of regularly performing these exercises (pause-gymnastics) was stressed. Furthermore, demonstrations of the proper use of equipment such as chairs, cushions, and lamps were conducted, and participants discussed and practised their application.

Group B ($n=28$). In addition to attending a traditional neck school, participants in this group received a variety of measures to enhance compliance. Accordingly, group members were visited by the physiotherapist at their individual workplace during the second week of the intervention. Possible ergonomical changes based on the secretaries' own views as well as on the physiotherapist's observations were discussed. Furthermore, the secretaries were individually interviewed by a psychologist with regard to psychosocial work factors including work organization with the aim of arriving at a personal coping strategy. The total additional time allotted to group B, in relation to group A, was 2 hours per individual.

Several methods to enhance compliance still further were utilized. Firstly, only measures agreed upon by the secretaries themselves were included in the individual programmes. Secondly, the participants received written instructions for a pause gymnastics programme (1–2 min with components of active exercises as well as relaxation) which were carefully scheduled to ensure maximum effect and compliance. Thirdly, a written list of all measures agreed upon, including the scheduling of pause gymnastics, was given to the secretaries. Finally, follow-up contacts, which participants agreed upon in advance, were carried out after three months.

Group C ($n=26$). The control group was assessed at pre, post and follow-up periods, but the subjects were not offered any intervention by the study team until after completion of their follow-up assessments.

Attendance

When secretaries were unable to attend lectures, additional opportunities were provided. Attendance rate was 100% for group A and 98% for group B, where two individuals received 3 lectures instead of 4.

Expectancy

Since two different interventions were offered it was considered important to measure if this would create a difference in expected outcome. Expectancy in itself might affect the results in favour of the reinforced programme. Consequently, the participants were, after having had their respective programmes presented to them, asked to answer 4 questions adapted from Borkovec & Nau (5). The questions asked were how relevant the programme was, whether it could be recommended to others, and how successful it might be for neck and shoulder, as well as back pain. Each question used a 1–10 scale anchored by e.g. "not at all relevant" and "very relevant". The same questionnaire was presented again at the completion of the neck school lectures.

Ergonomical knowledge

A multiple choice questionnaire was constructed with 13 questions (range 0–49 points) covering the neck school material. This test was applied in groups A and B ($n=53$) prior to and at the completion of the neck school.

Daily ratings of muscular fatigue and pain

Daily ratings of muscular neck and shoulder fatigue and pain were carried out at work. The secretaries were asked to complete five days of ratings and an assistant collected the rating sheets once a day. Depending on whether the secretary worked part-time or full-time, ratings were carried out 3 or 4 times daily. One hundred millimeter visual analoge scales anchored by extremes e.g. "no pain" and "considerable pain" were used. Days off, occasional sick days or poorly completed ratings, were compensated for by extending the rating period accordingly.

Daily ratings of workload

Estimated workload was rated once daily, using a 100 mm visual analogue scale anchored by "unusually little to do" and "unusually much to do".

Range of motion

Active range of motion for the neck was measured at the pre, post and follow-up periods according to the procedure recommended by the American Academy of Orthopaedic Surgeons (1). A Myrin goniometer (23) was used with the participant seated in a chair with an arm- and back-rest. At each assessment period, flexion and extension, lateral flexion, and rotation were measured twice.

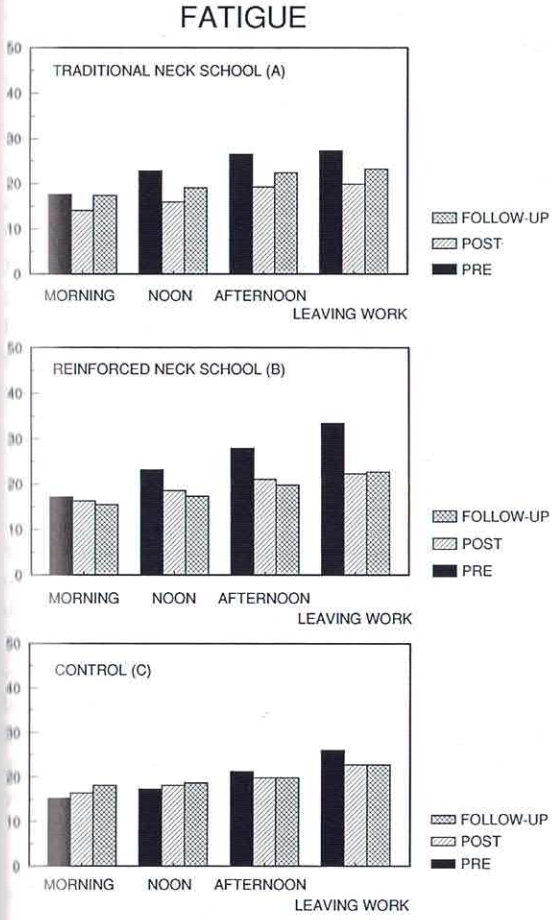

Fig. 1. Mean intensity ratings for muscular fatigue, measured on a visual analogue scale 0–100 mm (no fatigue—considerable fatigue) for the three groups. A = traditional neck school, B = reinforced neck school and C = control.

Headache and low back pain

The participants rated headache and low back pain at the pre, post and follow-up periods. One hundred millimeter visual analoge scales were used, anchored by "no pain" and "considerable pain".

Sick leave

Information regarding sick leave was obtained from the Swedish Social Insurance Service after permission from the secretaries. Diagnoses, number of sick leave occasions, and number of days on sick leave were registered.

Follow-up interview

At follow-up the secretaries were asked, in addition to the previously described post test procedure, how many changes they had implemented at work and how many pieces of equipment they had acquired since the programme was started. Adherence to the individual programmes agreed upon for group B were checked.

The secretaries were also interviewed concerning the number of visits they had paid to a physician, physical therapist or chiropractor etc. for neck and shoulder pain or headache, since the completion of the four-week programme.

Statistical methods

For between group comparisons the general procedure for the visual analogue scale ratings was to calculate gain scores (i.e. pre scores minus post scores and pre scores minus follow-up scores) and then to compute a Kruskal-Wallis one-way analysis of variance to check for overall effects. If the result was significant a Mann-Whitney U-test was performed for pairwise comparisons. For within group comparisons differences between pre and post respectively pre and follow-up periods were tested with the Wilcoxon matched-pairs signed-ranks test.

When appropriate, parametric tests were employed. For between group comparisons an analysis of covariance with pre score values as the covariate was used to check for overall effects. In the case of significant results post hoc comparisons with the Tukey HSD test were carried out.

For the purpose of statistically controlling for the effects of self rated experienced workload on muscular fatigue and pain, the visual analogue scale ratings were incorporated in a multivariate analysis of covariance.

RESULTS

Ergonomical knowledge

When ergonomical knowledge was analysed the 2 treatment groups were combined since the educational content of the neck schools had been identical. The ergonomical test showed that the secretaries were well informed prior to attending the neck school. The mean pre test score was 37.6 (SD 2.9) out of 49 possible points. After completion of the neck school the participants had increased their mean score to 42.9 points (SD 3.0). The difference was significant (t-test for paired samples, $t=11.06$, $p<0.000$).

As expected, no significant between group difference was found when post score values were compared using pre score values as the covariate.

Expectancy

The mean value of the 4 expectancy questions was calculated and a Kruskal-Wallis analysis of variance was employed to test for between group differences at the start of the programme respectively at the end of the neck school. There was no significant difference in expectancy between the two groups either at the start of the programme or at the end of the neck school lectures.

Daily ratings of muscular fatigue and pain

For the 2 outcome variables fatigue and pain, mean intensity ratings were calculated for each of the 4

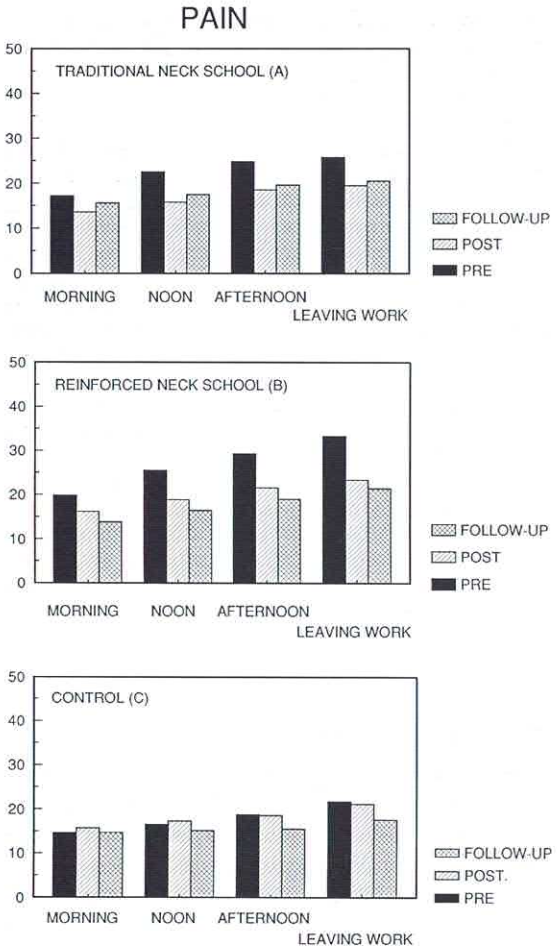

Fig. 2. Mean intensity ratings for muscular pain, measured on a visual analogue scale 0–100 mm (no pain—considerable pain) for the three groups. A = traditional neck school, B = reinforced neck school and C = control.

daily rating periods at pre, post, and follow-up tests. A general trend for the scores to increase during the course of the day was observed. There were no significant differences between the groups at pre test for the variables fatigue and pain (Figs. 1–2).

Between group comparison. The groups were compared at post and follow-up, employing mean gain scores in Kruskal-Wallis analyses of variance for fatigue as well as pain for each of the 4 daily rating periods. At the *post test* the only significant between group difference was found for the variable fatique at noon ($\chi^2_{approx}=6.24$, $p=0.4$). The post hoc analyses (Mann-Whitney U-test) showed that group A had a significantly larger decrease in fatigue than did group C ($z=-2.58$, $p=0.01$).

However, there were no significant differences between groups B and C or between groups A and B. At *follow-up* no significant between group differences were found.

Within group comparison. Within each group differences were analysed using the Wilcoxon test. At *post test* both intervention groups experienced less fatigue and pain than at pre test, primarily in the afternoon and when leaving work. No significant changes were found for the control group (Table I). At the *follow-up* period significant changes were found only for group B, where less fatigue and pain were experienced in the afternoon and when leaving work (Table I).

Daily ratings for workload

When *between group* differences for estimated daily workload were analysed (Kruskal-Wallis), no significant differences were found at post or follow-up periods.

When *within group* differences were analysed however (Wilcoxon's test), group A was found to have had significantly less to do at the post assessment period as compared with the pre period ($z=-2.01$, $p=0.04$). No other significant within group differences were found.

Effect of workload on ratings of muscular fatigue and pain

In an attempt to statistically control for the effect of experienced workload on muscular fatigue and pain, multivariate analyses of covariance were performed. Group differences were tested for each of the two variables, simultaneously using gain scores from noon, afternoon, and leaving work as effect variables in the statistical model. Workload gain scores were used as the covariate.

When workload was thus controlled, no significant *between group* differences were found at post or follow-up periods for either fatigue or pain.

The *within group* comparisons were analysed by using pre and post or pre and follow-up scores as effect variables in a repeated measures model. Workload scores at pre and post or pre and follow-up tests were used as covariates. The number of significant differences was reduced, particularly for group A (Table II). However, the overall picture, that of greater improvement for the reinforced group (cf. Table I), was not changed.

Table I. *Within group differences for muscular fatigue and pain comparing pre test ratings with post test and follow-up ratings*

	Groups		
	A Traditional neck school *p*	B Reinforced neck school *p*	C Control *p*
Fatigue			
Pre–post			
Morning	NS	NS	NS
Noon	0.01	NS	NS
Afternoon	0.01	0.05	NS
On leaving work	NS	0.03	NS
Pre–follow-up			
Morning	NS	NS	NS
Noon	NS	NS	NS
Afternoon	NS	0.02	NS
On leaving work	NS	0.03	NS
Pain			
Pre–post			
Morning	NS	NS	NS
Noon	0.01	NS	NS
Afternoon	0.02	0.04	NS
On leaving work	0.05	0.02	NS
Pre–follow-up			
Morning	NS	NS	NS
Noon	NS	0.04	NS
Afternoon	NS	0.04	NS
On leaving work	NS	0.05	NS

Range of motion (ROM)

At each assessment period ROM was measured twice and the mean values were used in the statistical analyses. The mean ROM at pre test ($n=79$) was 345° (SD 45°). *Between group* differences at post and follow-up assessment periods were calculated by analyses of variance, using pre values as covariate. No significant differences were found between the groups at either the post or follow-up periods.

The mean values showed little change from pre to post to follow-up periods in all groups and consequently *within group* comparisons were not tested statistically.

Headache and low back pain

Fifty-five persons made one-time pre, post, and follow-up ratings of headache and low back pain (Group A=17, Group B=20, Group C=18). Gain scores (pre minus post and pre minus follow-up) were used in Kruskal-Wallis analyses of variance for the between group comparisons.

For *headache intensity* no significant *between group* difference was found either at post test or at follow-up. Likewise the *within group* comparisons (Wilcoxon's test) showed no significant changes from pre to post test nor from pre to follow-up for any of the groups.

A significant *between group* difference was found for *low back pain* at the post test $\chi^2_{approx}=12.33$, $p=0.002$). Post hoc comparisons with the Mann-Whitney U-test showed significant improvement from pre to post test for group A as compared with group B ($z=-2.90$, $p=0.004$) and the control group ($z=-3.04$, $p=0.002$) but no significant difference was observed between groups B and C. At follow-up no significant between group differences in back pain were seen. The *within group* comparison of back pain showed that only group A had significanly lower ratings at post test when compared with pre test

Table II. *Within group differences for muscular fatigue and pain after statistical control for the effect of workload*

	Groups		
	A Traditional neck school *p*	B Reinforced neck school *p*	C Control *p*
Fatigue			
Pre–post			
Morning	NS	NS	NS
Noon	0.02	NS	NS
Afternoon	NS	NS	NS
On leaving work	NS	0.03	NS
Pre–follow-up			
Morning	NS	NS	NS
Noon	NS	NS	NS
Afternoon	NS	0.03	NS
On leaving work	NS	0.02	NS
Pain			
Pre–post			
Morning	NS	NS	NS
Noon	0.01	NS	NS
Afternoon	NS	0.05	NS
On leaving work	NS	0.02	NS
Pre–follow-up			
Morning	NS	NS	NS
Noon	NS	0.03	NS
Afternoon	NS	0.02	NS
On leaving work	NS	0.02	NS

($z=-2.35$, $p=0.02$). At follow-up no significant differences within the groups were found.

Sick leave

The mean number of sick days and sick occasions was calculated for all diagnoses as well as for diagnoses related only to musculoskeletal disorders (headache, neck–shoulder pain, and back pain). The six-month follow-up period was compared with the equivalent period (with respect to number of months and time of year) preceding the treatment period. On the average, the secretaries were sick-listed for less than one day per month when all diagnoses were combined, and less than a quarter of a day per month when only diagnoses pertaining to musculoskeletal disorders were included (Table III). Between group differences were analysed employing analyses of covariance with pre values as the covariate. There were no significant differences in sick days per month for all diagnoses or for musculoskeletal disorders only. Likewise there were no significant differences in number of sick occasions for all diagnoses or for musculoskeletal disorders only.

Implemented changes and acquired equipment

At the follow-up interview all individuals were asked to list changes they had implemented at work and equipment they had acquired since the start of the programme. All groups were asked about paus gymnastics which, if performed, was included under "changes".

There was a significant difference between the groups regarding the number of *implemented changes* (Table IV). The post hoc analyses (Tukey HSD) showed that the reinforced group (B) had implemented significantly more changes than the other two groups ($p<0.05$). The difference between groups A and C was not significant. For the reinforced group, 37% (19/51) of the implemented changes consisted of pause gymnastics. For all groups combined, the most frequently implemented changes were pause gymnastics ($n=31$), adjustment of table or chair ($n=7$), de-

Table III. *Mean number of sick days and sick occasions per month for all diagnoses together, and for musculoskeletal disorders (headache, neck, shoulder and backpain)* only

Assessment periods averaged 6 months before and after the treatment period, respectively ($n=76$)

	Diagnoses							
	All diagnoses				Musculoskeletal			
	Before		After		Before		After	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Sick occasions	0.23	0.18	0.24	0.24	0.03	0.08	0.05	0.16
Sick days	0.83	1.32	0.99	1.69	0.05	0.18	0.28	1.17

liberately standing up more frequently ($n=11$), relaxing ($n=6$), resting hands more frequently when typing ($n=4$), and discussing a particular problem with a superior ($n=4$).

The reinforced group had acquired more than twice the number of pieces of *equipment* compared with the other two groups (Table IV). The difference was not significant, however. The most commonly acquired items (all groups) were lamps ($n=11$), chairs ($n=9$), foot rests ($n=4$), manuscript holders ($n=4$), new tables ($n=3$) and sets of blocks for increasing table height ($n=3$).

Compliance with the individual programmes for group B

The participants of the reinforced group (B) had all received written programmes. According to these a total of 64 changes were agreed upon, while 51 (80%) were actually carried out. Pause gymnastics was included as a change, provided it had been carried out at least half of the agreed number of times.

According to the individual programmes, pause gymnastics should have been carried out on an average of 3.7 times per day (range 2–6 times). However, the mean number of times actually carried out was 2.2 (range 0–4 times). During the follow-up rating weeks, 44% (11/25) of the participants had practised pause gymnastics at all of the agreed times, 32% (8/25) had carried out about half of their programme and 24% (6/25) had only carried out gymnastics sporadically or not at all.

A total of 31 pieces of equipment should have been acquired according to the agreements made. Twenty-four items had actually been acquired, 1 was ordered and 4 had been refused. Thus group B had tried to acquire 94% of the equipment agreed upon. In addition, 6 items not included in the individual programmes, had been acquired.

Additional health care contacts

During the time that had elapsed from post test to follow-up a total of 13 individuals sought treatment outside the programme for headache (group A=1, group B=6, group C=0) as well as for neck and shoulder pain (group A=1, group B=2, group C=3).

Table IV. *Total number of implemented ergonomical changes and acquired equipment from start of programme till follow-up*

	Groups				
	A Traditional neck school ($n=25$)	B Reinforced neck school ($n=26$)	C Control ($n=25$)	Analysis of variance	
				f	p
Changes	16	51	8	19.50	0.001
Equipment	13	30	13	2.56	0.08

DISCUSSION

This study investigated the efficacy of a neck school as a preventive measure for neck and shoulder disorders. Compliance, which is essential in evaluating outcomes, was greater in the reinforced neck school group (B), as predicted. However, when workload was controlled, there were no significant improvements on muscular fatigue and pain when comparisons were made between groups. When comparisons were made within groups some significant positive effects were noticed, particularly in favour of the reinforced group. Ergonomical knowledge was found to be good even before the intervention was started.

Berwick et al. (4) combined back school with a compliance enhancing programme, but failed to show any measurable effect on back care exercises or health status. By contrast, the compliance strengthening programme in the present study *did* result in improved compliance. The reinforced neck school group (B) implemented significantly more ergonomical changes than the other two groups, whereas there were no significant differences between the traditional neck school group (A) and the control group (C). Consequently, the failure of this study to demonstrate a decrease in neck and shoulder discomfort did not occur as a result of poor compliance, but rather, despite good compliance.

An interesting finding regarding ergonomical knowledge was that the secretaries already were well informed prior to the neck school. As a result the school fell short of fulfilling one of its primary goals, that of offering substantial additional knowledge. Although it might have been expected that the reinforced group (B) would have gained more knowledge during its additional contacts with the physical therapist, this did not seem to be the case since no group difference was found at post test. The role of knowledge in back care has been questioned. Scholey & Hair (24), for instance, found no difference in back pain prevalence and incidence when comparing a group of physiotherapists involved in back care with an age and sex matched control group from nonmedical occupations. The authors suggest that one of the reasons may be that the education is not appropriate.

When trying to interpret why muscular discomfort ratings were not particularly affected by the intervention, one should observe that mean daily discomfort ratings did not exceed 35 mm on the 100 mm VAS, indicating that the participants generally did not suffer severe muscular fatigue or pain. Thus, the range for improvement was limited, possibly making it more difficult to demonstrate a significant decrease in pain. Some caution in interpreting the within group results is also warranted, since the reinforced group (B) rated on the average more pain and fatigue at pre test than the other groups. Although the difference was not significant, this may nevertheless have made it easier to achieve the observed positive improvements.

The largest number of significant improvements within the groups was observed for the reinforced group (B). Since this group had also been offered the more elaborate programme it is possible that greater expectancy had created a placebo effect. Analyses of the expectancy questions showed however that there was no difference in expectancy between the two treatment groups and both groups found the offered treatment highly relevant.

The outcome variables "headache" and "low back pain" also failed to demonstrate any convincing improvements in favour of the neck school. The improvement in back pain, experienced by group A at post test, might have been a result of the reduction in workload rather than the intervention.

Limited range of motion (ROM) may in part be the result of muscular tension and pain. Consequently, a treatment programme such as a neck school which includes the alleviation of muscular tension, should, if successful, be able to show an increase in ROM. The measuring technique used in the present study has previously been shown to be reliable (7) and able to measure treatment effects successfully (8, 23). The failure to demonstrate an increase in ROM may partly be explained by the fact that the ROM did not seem to be greatly limited when compared with the reported normal ROM (16).

Additional health care contacts may be regarded as an adverse outcome variable. The less effective the programme, the more likely will it be that subjects seek other help. No such effects could be noticed, however, since only a few secretaries had sought treatment elsewhere and these were fairly evenly divided between the groups.

The subjects in the present study in general reported fewer sickdays per person than has been presented in other reports on sickleave for women in Sweden (6). On the other hand, the present study only included secretaries currently working, thus eliminating individuals who during the intervention period were on long term sickleave. There was no indication that sickleave had been affected by the intervention. This

is in accordance with several back school studies which have failed to show a favourable effect on sickleave (9, 17, 26).

When viewing the limited effect of neck school found in this study, psychosocial workplace factors may deserve some further attention. Special care had been taken to ensure that they were included in the reinforced neck school programme. The psychologist tried not only to identify the problems, but also to formulate strategies to alleviate them. This proved to be more difficult than expected, and although many secretaries agreed that work organization, as well as social relations at work, needed to be improved, it was difficult to formulate measures which the individual secretary felt could be carried out. In fact, out of the 64 changes agreed upon by the reinforced group (B), only 8 pertained to psychosocial problems. One factor in particular over which the intervention programme had no control was the total workload. The results indicate however, that it was a factor of importance, since, when the workload was subjected to statistical control positive effects were diminished.

In summary, despite good compliance, there was little indication that neck school had any effect of clinical importance on muscular discomfort. Two factors in particular are thought to have contributed to this. Firstly the neck school offered only limited new knowledge and secondly the psychosocial work related factors were not easily modified on an individual level.

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