UNIVERSITY OF MEDICINE AND PHARMACY OF CRAIOVA

PhD THESIS

- ABSTRACT-

Clinical and therapeutical aspects of musculoskeletal disorders to computer workers

Ph.D. Thesis Coordinator:

Prof. Dr. Roxana Sanda Popescu

PhD Student:

Andreea Niţă

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Key words: computer work, work-related musculoskeletal complaints, ergonomics, therapeutic exercises.

Abstract

Existing state of knowledge

Introduction. Occupational medicine reported the occurrence of a new pathology related to computer workers: visual disturbances, musculoskeletal symptoms, chronic fatigue syndrome.

Etiology. Work-related musculoskeletal diseases have many risk factors: physical, psychosocial and individual. The factors also intricate and are influenced by organizational and cultural factors as well.

Physiopathology. Many hypotheses have been proposed for the pathogenesis of work-related musculoskeletal symptoms: muscular overuse, prolonged exposure to improper postures, repetitive movements.

Nosology. Repetitive strain injury (RSI) is an "umbrella" term for diseases that develop as a result of repetitive movements, awkward positions or impact forces. Most work-related musculoskeletal symptoms can not be classified in diseases or clinical syndromes. It is estimated that specific diseases are responsible for only 13-27% of the repetitive complaints. 3 stages were defined for work-related RSI : Stage I - pain and fatigue present only during professional activity; Stage II - symptoms occur faster during working hours and are present during non-work daily activities; Stage III - symptoms persist during sleep and rest.

The most frequently reported location for computer work-related musculoskeletal symptoms was the neck 26-59.3%, followed by upper limb pain locations 13.9-41%, upper dorsal 28% and low back 6.6-34%.

Assessment methods. Most commonly used assessment methods for occupational musculoskeletal disorders are selfreported questionnaires: Maastricht Upper Extremity Questionnaire, Dutch Musculoskeletal Questionnaire, Nordic Musculoskeletal Questionnaire.

Therapeutic intervention. The main therapeutic goal is to relieve pain and accompanying symptoms (muscular stiffness, paraesthesia). The treatment is symptomatic. Surgery is reserved for advanced cases, when the tissue damage occurred (tendinitis, neuritis of incarceration), but these cases are extremely rare in relation to computer work. Ethiologic treatment is rather a preventive intervention on risk factors. Most cases are treated as outpatients, especially in rehabilitation centers. The physical training for musculoskeletal disorders to computer workers is discussed in the literature in two aspects: general physical training (achieving and maintaining an adequate fitness level) and specific exercises for muscles involved (muscles of the spine and upper limb). Other treatments are discussed in the literaturare: manual massage, analgesic and decontracturant electrotherapy (TENS, interferential currents), thermotherapy with hot or cold applications to affected regions, acupuncture, analgesics. Although studies have demonstrated therapeutic effects of these methods on musculoskeletal symptoms, none of the methods

above is specific to a certain disorder nor superior to any other method in terms of efficiency. A special attention can be given to myofeedback training..

Personal contributions

I. Retrospective study on the anual prevalence of musculoskeletal complaints to computer workers and occupational risk factors

Objectives: 1.the assessment of 1-year prevalence of musculoskeletal complaints in a population of Romanian computer workers; 2. the assessment of working conditions - ergonomic and psychosocial factors - as potential risk factors for the devlopement of occupational musculoskeletal complaints; 3. analysis of self-reported musculoskeletal symptoms characteristics of computer workers, its influence on professional activities and the daily lives of subjects and an analysis of the therapeutic approach.

Materials and methods

This is a retrospective cohort study performed since November 2009 to October 2010 on a sample of computer workers from several institutions in Romania, working in different areas - IT, commerce, administration, insurance. They were asked to complete a questionnaire about computer work and musculoskeletal complaints. The participants also received an information letter about the study and about the confidentiality conditions. We distributed 258 questionnaires and received back 232 (an answer rate of 92%). The cohort consisted of 232 computer workers who responded to questionnaire.

The assessment was conducted with a self-reported questionnaire elaborated on the base of questionnaires internationally confirmed. The aim of our questionnaire is to colect data about work conditions, physical and medical condition of computer workers during the previous 12 months.The questionnaire consists of 62 items with a completion time of 10-15 minutes. These items are gruped in six main domains: general information for demographics data, work characteristics, workplace and workstation characteristics, psychosocial characteristics, health and physical activity status, musculoskeletal complaints (if they are present).

Statistical methods. We used the descriptive statistic for demographic data and complaints analysis. In analytic statistic, we used chi-square test and risk analyze with relative risk (RR) indicator with the confidence interval (CI). A p-value ≤ 0.05 was considered statistically significant.

Results

Demographic and occupational characteristics of the study population. The gender distribution in the cohort was almost even: 111 men and 121 women. The majority of responding computer workers (88%) was under 40 years old. Looking to occupational characteristics of studied population, we observed that the majority of computer workers had a computer-working program of 5 days per week (95%) and over 4 hours per day (59%). The data reflects the importance of computer work in actual economy.

The 1-year prevalence of work related musculoskeletal complaints to computer workers. The data analysis revealed that the prevalence of work-related musculoskeletal complaints to computer workers of the cohort during the previous year was 47%. The gender 1-year prevalence was 38.7% to men and 54.5% to women. We find the highest prevalence for neck localization of musculoskeletal complaints - 23.3% and the lowest prevalence for elbow localization – 1.7%. The most frequent localization for men was the low back (17.1%) and for women the neck (34.7%). The results are comparable with those in the relevant international literature.

The analisis of idividual risk factors. We examined individual factors - gender, age, seniority, body mass index, physical activity level - in order to determine the potential risk they pose. Thus emerged as risk factors for developing musculoskeletal symptoms in computer users professional: women (RR = 1.41, CI:1.06-1.87) and older than 40 years (RR = 1.44, CI:1.09-1.89) .

Analysis of risk factors related to working conditions. The risk analysis has revealed that risk factors related to working conditions are the lack of work breaks or the duration of breaks under 5 minutes (RR = 1.44, CI:1.10 - 1.89). Analyzing data related to quality psychosocial conditions, we have also identified as a risk factor psychosocial problems at work (RR = 1.64, CI: 1.21-2.12). On the other hand it was revealed that the existence of an adequate psychosocial, pleasant workplace is a protective factor for the occurrence of musculoskeletal symptoms (RR = 0.63, CI: 0.478-0.838).

Analysis of the conditions related to equipment and workstations. Statistical significance was found in combination with thermal discomfort (RR = 1.64, CI: 1.26-2.13), inadequate ventilation (RR = 1.42, CI: 1.09-1.85), the weak possibilities for adjusting the seat (RR = 1.53, CI: 1.17-2.02), difficulty in or total absence of backrest adjustment thereof

(RR = 1.7, CI: 1.31-2.19), lack of arms support (RR = 1.64, CI: 1.27-2.12) and postural discomfort (RR = 1.66, CI: 1.28-2.14).

Analysis of risk factors symptoms depending on the location. Risk factors for neck localization are: women (RR = 3.21, CI: 1.78-5.78), age over 40 years (RR = 2.03, CI: 1.28-3.22), short duration of pauses (RR = 1.8, CI: 1.03-3.12), psychosocial problems at work (RR = 2.87, CI: 1.7-4.87), failure of seat adjustment (RR = 1.79, CI: 1.09-2.92), lack of supports for arms (RR = 2.2, CI: 1.4-3.46) and postural discomfort (RR = 1.66, CI: 1.04-2.63). Risk factors for shoulders localisation are: age over 40 years (RR = 2.36, CI: 1.25-4.46), psychosocial problems at work (RR = 2.86, CI: 1.38-5.91), thermal discomfort (RR = 2.71, CI: 1.44-5.11), lack of supports for arms (RR = 2.07, CI: 1.09-3.96) and postural discomfort (RR = 2.95, CI: 1.53-5.53). Risk factors for low back localisation are: age over 40 years (RR = 2.01, CI: 1.12-3.61), body mass index> 25 (overweight and obese) (RR = 1.88, CI: 1.06-3.34), low physical activity (sedentary) (RR = 1.88, CI: 1.03-3.42), thermal discomfort (RR = 2.08, CI: 1.14-3.79), failure of seat adjustment (RR = 2.15, CI: 1.19-3.89), lack or unable backrest adjustment (RR = 1.95, CI: 1.1-3.46), lack of supports for arms (RR = 2.01, CI: 1.12-3.61) and postural discomfort (RR = 1.83, CI: 1.03-3.26). Risk factors for localisation to whole spine are: women (RR = 2.29, CI: 1.23-4.25), absence or inability backrest adjustment (RR = 2.41, CI: 1.41-4.11), lack of supports for arms (RR = 1.92, CI: 1.1-3.33) and postural discomfort (RR = 2.06, CI: 1.2-3.52).

Analysis of musculoskeletal symptoms in the studied population. Reference group consists of the 109 subjects who reported having the symptoms. Most subjects (78.9%) confirmed the presence of musculoskeletal symptoms is related to computer work. Most of them stated that symptoms began after starting the computer professional activity (49.5%). In 21.1% of subjects symptoms appeared before the computer professional activity, to 29.4% occurred before and intensified after the start of work. Most subjects showed symptoms at spine level, its different segments (49.5% cervical 11% thoracic, 34.9% lumbar) or completely (38.5%). Regarding the location of the upper limb symptoms, the highest incidence was observed in the shoulder: 29.3%. Only a few patients showed symptoms in the upper limb, the elbow and wrist location. Analysing symptoms by gender, there are statistically significant differences: women present a greater frequency of symptoms in the neck (p = 0.0004), for other localisations there are no statistically significant differences related to gender. The predominant symptom reported was pain

(73.4%). Other frequently reported symptoms were muscle stiffness (25.7%) and paresthesia (31%). In terms of gender differences, women reported significantly more presence of stiffness ($p = 0.02$). Most subjects had mild symptoms (58.7 %) or low (26.6%). The presence of symptoms affecting "in a small extent" for most daily activities (67.9%) out of the symptomatic subjects interviewed. 14.7% of the subjects reported musculoskeletal symptoms that does not affect all daily activities, and 17.4% reported a significant impairment of daily activities. 38.5% of subjects reported decreased ability to concentrate due to the presence of symptoms. Although they are not a majority we can appreciate that they represent a significant percentage of computer workers. Regarding the temporary inability to work due to occupational musculoskeletal disorders, most subjects (85.3%) did not require sick leave for musculoskeletal symptoms, 8.3% had required more than 7 days off. 35.8% of subjects had turned for medical advice for musculoskeletal complaints. Most cases (47.7%) did not follow any treatment. The most common therapy was: medication (34%) and physiotherapy (29%).

II. **Therapeutic interventional study on the efficiency of rehabilitation programs for computer workers with neck and shoulder musculoskeletal complaints.**

Objectives: 1.To evaluate the efficiency of two programs - physiotherapy (electrotherapy and massage) or physical-kinetic therapy (electrotherapy, massage and specific kinetotherapy) - applied during periods of painful decompensation of neck and shoulders chronic disorders to computer workers. 2. To assess the medium term (6 month) effectiveness of a home exercises program for neck and shoulder muscles.

Materials and methods

Type of study Within two years (March 2009 - February 2011), we have performed an interventional therapeutic study (follow-up for 6 months) on patients with neck and shoulder chronic musculoskeletal complaints related to computer work that followed a specific rehabilitation therapy in medical units from Timisoara. Subjects were informed about the study and signed informed consent. Out of the 222 subjects initially enrolled in the study, 58 were withdrawn over time, so that at the end of the study, 164 subjects remained. Statistical analysis was performed on this sample of 164 subjects divided into 2 groups: Group 1, consisting of 92 patients, received physical treatments (electrotherapy and massage) 10 sessions / 2 weeks in ambulatory and Group 2, consisting of 72 patients, received physical-kinetic treatments (electrotherapy, massage and specific kinetotherapy)

10 sessions / 2 weeks in ambulatory followed by a continuing program of specific exercises at home for 6 months.

Assessment methods For information related to computer work and musculoskeletal complaints we used the same questionnaire as in the retrospective study described above. The data was supplemented by a clinical examination of patients and by scales for pain application (VAS) - which we evaluated: pain level assessed by the patient at the time of evaluation (noted VAS) and the greatest pain experienced last month (noted VASM) - and a functionality scale for neck (Neck Disability Index - NDI). For pressure pain threshold (PPT) assesment we used an electronic pressure algometer (Sbmedic, Algometer type II, Solna, Sweden) purchased by Medical Rehabilitation Unit of the University of Medicine and Pharmacy from Craiova. The tested points were those from the upper trapezius muscle, respectively midway between C7 spinous process and the acromion, bilaterally. We considered as reference the point with highest tenderness (lowest PPT). This was used on further assesments (2 weeks and 6 months). The compliance to ergonomic rules was assesd to final evaluation by self-assessment done by the patient on a 6-point Lickert scale.

Patients were assessed at baseline (T1), after the 10 therapy sessions respectively at 2 weeks (T2) - and after 6 months (T3) by: VAS, NDI and PPT. To complete the assessment maximum pain level in the last month (VASM) was aplied in T1 and T3 stages only.

Therapeutic methods

Ergonomic education. At the first visit we discussed with each patient individually about the computer working conditions and we offered advice on ergonomics.

***Therapy for cervico-brachial syndrome*.** In first phase all patients in the study followed a daily rehabilitation program (10 sessions). Group 1 followed a program consisting of electrotherapy and therapeutic massage. For Group 2 an exercises program was added. In the second phase (6 months), Group 1 was the control without therapeutic intervention and Group 2 continued the exercises program at home, for 6 month.

Therapeutic methods: ***Electrotherapy:*** TENS (transcutaneous electrical stimulation), bipolar or tetrapolar interferential current in analgesic regional applications, ultrasound - mobile field applications on the trapezius. ***Classical manual massage*** was applied by specialized therapists who seted techniques, intensity and duration according to diagnosis, symptoms and condition. In designing ***therapeutic exercise programs*** for Group 2 we considered the possibility for such programe to be performed at home or in a gym.

The program was focused on tonifying neck and shoulder muscles and was completed with warm-up and cool-down exercises. The training consisted of progressive resistance exercises with dumbbells for neck and shoulders. Duration did not exceed 30 minutes. Patients performed the program 3 times a week for 6 month after properly acquiring it under direct supervision of a specialized physiotherapist (10 supervised sessions).

Statistical methods. In analytic statistic, we used chi-square test. A p-value ≤ 0.05 was considered statistically significant.

For monitoring the patients evolution by rehabilitation therapy we used the three different stages described for work related repetitive strain injury (RSI) according to the clinical status of patients: Stage I – neck and shoulder complaints present only during professional activity; Stage II - neck and shoulder symptoms occur faster during working hours and are present during non-work activities; Stage III - neck and shoulder symptoms persist during sleep and rest. We added also de Stage 0 characterized by lack of complaints (this stage was present only to follow-up).

We used also the correlation and linear regression analysis. The regression analysis was performed differently on each group and at each time T1, T2, T3 to determine the RSI stage. For each particular analysis two models were created: one with all exogenous variables and a second one in which were kept only predictive variables on the endogenous variable RSI stage.

Results

Demographic characteristics, occupational and diagnosis for the 2 groups. At the baseline, demographical parameters of two groups were similar in regards to gender, age, BMI, seniority, daily work at the computer. We observed a predominance of women for both groups – 82.6% in Group 1 and 77.8% in Group 2. The clinical diagnosis were: tension neck syndrome (52.2% in Group 1, 50% in Group 2), cervical radicular syndrome (32.6% in Group 1, 27.8% in Group 2), non-specific neck and shoulders complaints (15.2% in Group 1, 22.2% in Group 2). At the baseline, the 2 groups were comparable in terms of distribution according to RSI stages. Most patients in both groups were diagnosed with stage II - 65.2% patients in group 1, 72.2% patients in group 2.

Parameters at T1. The regression analysis showed correlation between T1 initial RSI stage and certain patient characteristics: age, sex, number of hours spent daily on the computer. Therefore older age, female gender and a longer exposure to computer working

are associated with more advanced RSI stages. These results are similar to those of other international studies.

The evolution of parameters at T2. The evolution of Group 1 in terms of RSI stage T2: 8 patients (8.7%) became asymptomatic, 32 patients (34.8%) remained at the same stage, and for 52 patients (56.5%) the clinical status improved, moving from stages II and III to stage I and II. No patient had a negative evolution in transition to a more advanced stage of disease. The evolution of Group 2 in terms of RSI stage T2: 12 patients (16.6%) became asymptomatic, 12 patients (16.6%) remained at the same stage, and for 48 patients (66.6%) clinical status improved, moving from stages II and III to stages I and II. No patient had a negative evolution in transition to a more advanced stage of disease.

After 10 sessions therapeutical programs (T2) all parameters (VAS, NDI, PPT) were significantly better for both groups ($p<0.001$, Table 1). There were no significantly statistic differences between groups after physical therapy for pain parameters (VAS, PPT) (Table 1). The functional index NDI was significantly statistic better ($p=0.02$) for group II with therapeutical exercises.

Table 1: Evolution of the clinical parameters after 10 sessions program (T2-T1)

Variable		**T1**	**T2**	**p***
VAS, mean±SD	**Group 1**	5.82±0.97	3.1±1.09	<0.001
	Group 2	5.69±1.19	2.6±1.16	<0.001
	p**	NS	NS	
NDI, mean±SD	**Group 1**	29.05±6.78	18.59±5.62	<0.001
	Group 2	29.68±5.07	15.47±6.85	<0.001
	p**	NS	0.02	
PPT, kPa/cm^2 mean±SD	**Group 1**	203.42±42.94	313.78±57.26	<0.001
	Group 2	215.16±44.82	309.29±61.52	<0.001
	p**	NS	NS	

p* - between-groups p value, p** - in-group p value, NS-non-significant,
<0.05 – significant, <0.001 – extremely significant

Correlation and regression analysis at T2. Analyzing the regression coefficients we find a lower RSI stage to T2 to subjects with a lower BMI. This evolution indicates that normal weight people responded better to physical therapy. The same conclusion can be drawn and the young people. An interesting thing that could be drawn from those who had a higher initial VAS score better respond to therapy, decreasing overall RSI stage rather than in people who had an initial VAS score lower.

The evolution of parameters at T3. The evolution of Group 1 in terms of RSI stage to T3: 5 patients (5.4%) became asymptomatic, 70 patients (76.1%) remained the same stage, for 7 patients (7.6%) clinical stage improved, moving from stage II to stage I

and 10 patients (10.9%) worsened going from stage 0 and stage I to stages I and II. The evolution of Group 2 in terms of RSI stage to T3: 16 patients (22%) became asymptomatic, 46 patients (64%) remained at the same stage, and for 10 patients (14%) clinical status improved, moving from stage II to stage I. No patient had a negative trend passing from a lower stage to a higher stage of disease.

After 6 month (T3) all parameters (VAS, NDI, PPT) were significantly better for Group 2 who performed home exercises program (Table 2). For control Group 1 the evolution was good and significantly statistic for VAS and NDI parameters, but non statistic significant for PPT (Table 2). The changes in value were significantly higher for VAS and NDI parameters for Group 2 who performed home exercises program (Table 2). The changes in value were non significantly for PPT between two groups (Table 2).

Table 2: Evolution of the clinical parameters after 6 month (T3-T2)

Variable		T2	T3	p*
VAS, mean±SD	**Group 1**	3.1±1.09	2.43±1.43	0.01
	Group 2	2.6±1.16	0.97±0.59	<0.001
	p**	NS	<0.001	
NDI, mean±SD	**Group 1**	18.59±5.62	14.9±6.84	0.006
	Group 2	15.47±6.85	8.55±5.64	<0.001
	p**	0.02	<0.001	
PPT, kPa/cm^2 mean±SD	**Group 1**	313.78±57.26	323.4±62.5	NS
	Group 2	309.29±61.52	346.44±65.91	0.01
	p**	NS	NS	

p* - between-groups p value, p** - in-group p value, NS-non-significant,

<0.05 – significant, <0.001 – extremely significant

VASM evolution from T1 to T3 showed significant improvements for both groups especially for Group 2.

Correlation and regression analysis at T3. Analyzing regression coefficients for the refined model of Group 1 (control) at the end of the study, it can be observed that lower age, lower BMI and ergonomic compliance relate with a lower RSI stage. For group 2 over 6 months, when applying the refined model lower RSI stage is related to female gender and lower BMI. To note that age and ergonomic compliance has not influenced the subjects who performed exercise at home.

Limitations of the study are related to the average monitoring period of 6 months. Monitoring patients for a period of at least one year after therapeutic intervention or physical-kinetic interventiuon would be useful for tracking long-term therapeutic effects.

Conclusions

1. Musculoskeletal disorders have a notable 1-year prevalence to Romanian computer workers, comparable to that of Western countries. Researching literature we didn't obtaine data on the prevalence of musculoskeletal disorders to computer workers in Romania, although they are recognized and integrated as occupational pathology in our country. This personal study, conducted on 232 computer workers from several institutions in the country, can be considered a debut in the field.

2. Occupational musculoskeletal disorders have multifactorial etiology. In the first study we identified as risk factors related to computer work: individual factors (gender, age) and work-related conditions (physical environment, psychosocial environment and aspects of work organization). Most patients were women with increasing age (over 40 years). Certain circumstances and working conditions can be considered risk factors: lack of or reduced break time, workstation conditions (especially the desk chair), working posture and the existence of psychosocial problems. Using the questionnaire related to working conditions and musculoskeletal disorders is useful for identifying risk factors. Recognition of risk factors requires occupational medicine and the law to generate a set of preventive conduct guidelines. In Romania there is a legal framework on the "minimum safety and health requirements on the use of equipment with display" aligned with European directives. It should be noted that the specific activity of the computer professional can be adjusted easily and without excessive costs. If replacing furniture involves certain costs, education related to ergonomic posture and the time spent on computer activity can be easily done as part of prevention programs, both primarily, for all employees, and secondary and tertiary, specific for computer workers who already have musculoskeletal disorders as part of the rehabilitation programes.

3. In our study, we identified the most common symptoms as located in the neck and spine, these symptoms are pain, numbness and stiffness. Low back localisation is frequently reported in this study but was found to be correlated with ergonomic deficiencies of workstation (especially the chair) with obesity and low physical activity, so

the lumbar symptoms are less related to the computer itself. Upper limb locations were rarely reported in this study except the shoulder.

4. The level of symptoms intensity reported by computer workers were mostly mild and average, but third of cases reported the impact on the daily activities and concentration skills. However, temporary work incapacity has been recorded only in 14.7% of cases, more than half of them less than seven days. Addressing the doctor was reported by one third of symptomatic computer users. Therapy was followed conservative, especially drugs and physical-kinetic.

5. In interventional clinical trial patients were computer workers with tension neck syndrome/ trapezius myalgia (51.2%), radicular pain syndrome / cervico-brachial neuralgia (30.5%) and non-specific neck symptoms (18.3%) . Most subjects in the study were normal weight women with an avearge age of 37.3 years. To the begining of the study most subjects were in stage II (presence of cervico-brachial symptoms not only during work but also in other daily activities), having mild pain and mild neck disability. We considered important to follow the RSI stages evolution because it shows the interference with work and other daily activities. Following up the evolutive stages proved to be a good indicator of therapeutic efficiency.

6. Complex rehabilitation therapy had a positive impact on short term (2 weeks) alevieting symptoms with statistically significant improvement in all parameters related to pain, pressure pain sensitivity and functional parameters evaluated, both for patients receiving only physical treatments (electrotherapy and massage) and those who have followed a training program with additional therapeutic exercise physical treatment. Responsivness to the two types of therapy was better at younger individuals with normal weight and higher initial pain intensity. Although the training period was short, differentiated results between the two types of therapeutic approaches have been observed since the end of this phase. Patients who performed specific exercises for cervico-brachial muscles recorded better results in terms of pain relief and statistically superior results in terms of functional improvement.

7. Home exercise program, conducted over a period of 6 months resulted in marked improvement of symptoms and even stopped disease progress. Statistically significant improvement in pain assessment parameters (VAS, PPT) and functional parameters recommended this program as therapy on medium and long term. A feature of this program

is to combine strength training exercises and warm-up/cool down general exercises, resulting in a complex program, in line with the recommendation of World Health Organization (minimum 30 minutes of physical activity daily).

8. Patient education regarding computer ergonomics has a significant effect in maintaining the treatment's results in the medium term (6 months) This is reflected especially on patients who receiving only the initial step in physical therapy. To these patients the success in maintaining and even improving clinical and functional parameters after 6 months of the treatment can be explained by increased attention for ergonomic behaviour. Discussions with patients on ergonomic issues, correlated with distribution of educational brochures proved effective, so we recommend to continue these activities.

9. Currently there are no therapeutic guidelines related to musculoskeletal disorders in computer work. The most common recommendations are ergonomic counseling, encouraging physical activity and exercise therapy. There are no guides on optimal exercise programs for this pathology. However leaving the patient without any therapeutic advice is frustrating for both the patient and the physician. The patient may have the feeling that his suffering is minimized. Although evidence-based medicine has so far only produced conflicting results about the optimal therapeutic approach, the therapeutic studies must continue. It is up to the physician's experience to recommend diverse and individualized approaches. We believe that therapeutic programs proposed in this study can be effective therapeutic alternatives and can be improved in the future.

10. Given the favorable results of the therapeutic alternatives we recommend as a therapeutic approach, for patients with chronic pain, a recurrent treatment program in a specialized rehabilitation center every 6 months (physical therapy or physical-kinetic therapy as described in this study) correlated with a home exercises program between these intervals. Recommended exercise program can be performed in any location (a gym or patient's home) with minimal costs. Employers may be directly interested in implementing physical therapy programs and treatments for rehabilitating the employees with musculoskeletal pathology due to their relatively low costs, which can easily be recovered by reducing absenteeism due to illness, and, why not, by retaining the employees. Occupational health specialists and primary care physicians have an important role to early detect musculoskeletal problems and to develop, together with the rehabilitation specialist, a prevention program, focused on ergonimics education and encouraging physical exercise.