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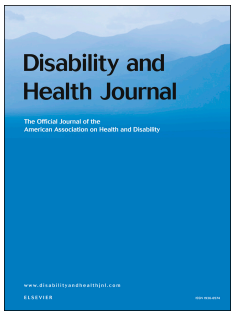

Effects of an ergonomic program on the quality of life and work performance of university staff with physical disabilities: A pilot clinical trial with three-month follow-up

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Title page

Effects of an ergonomic program on the quality of life and work performance of university staff with physical disabilities: a pilot clinical trial with three-month follow-up

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ABSTRACT

Background: Problems related to physical disability may have an extremely negative impact in the work environment, reducing productivity and contributing to health problems and a worsening quality of life.

Objective: To assess the effects of an ergonomic intervention program on the quality of life and the work performance of people with physical disabilities working in a university environment.

Methods: A pilot clinical trial with three-month follow-up was conducted at the XXX of the Federal University of XXX (Brazil). Eight workers at the university took part in an ergonomic adjustment (using ErgoDis/IBV software) and physiotherapy program at their workplace for twelve weeks, in two 60-minute sessions per week. The measuring instruments used were the WHOQoL-BREF questionnaire for quality of life and the Work Ability Index for work ability. A repeated-measures ANOVA analysis and Wilcoxon signed-rank test were also performed.

Results: Significant intra-group changes were observed in the QoL subscales for the physical dimension (F=5.487, p=0.017) and the environment dimension (F=7.510, p=0.006). The post-treatment analysis revealed significant changes for both the physical dimension (Z=-2.552, p=0.011) and the environment dimension (Z=-2.201, p=0.028). After the three-month follow-up period, only the environment dimension recorded a

significant change (Z=-1.965, p=0.049). The effect sizes were large. Regarding work ability, the repeated-measures ANOVA analysis showed a significant time effect (F=5.067, p=0.022), with large pre-post treatment improvement (Z=-2.555, p=0.011, d=0.914).

Conclusions: The program based on ergonomic and physiotherapy program greatly enhanced the subjects' quality of life and work ability.

Key words: Physical disability; University workers; Rehabilitation; Ergonomics; Quality of life; Work ability.

Introduction

People with physical disability are living longer and more active lives. There is growing interest in developing programs to facilitate their independent living, self-management and occupational capability. Health professionals in rehabilitation units should be aware of positive (feelings of accomplishment) and negative (anticipatory anxiety) aspects of these changes. Success in this regard can greatly improve the clients' quality of life (QoL) and decrease the progressive effects of their disability.[1,2] Pain, fatigue, deconditioning and mobility problems may all impose substantial limitations on body structures, functions and participation in instrumental activities of daily living such as employment.[3] Physical disability manifestations should not be evaluated in isolation, and its treatment should be contextualized from a biopsychosocial perspective.[4]

People with lifelong physical disabilities may encounter many obstacles to entering the labor market, including low self-esteem, lack of motivation, preconceptions, prejudice and reduced productive capability.[1] These problems are heightened by the existence of architectural and environmental barriers that hinder access to public places, including leisure facilities and the workplace. In addition, physical disability may have a negative impact on people's lives, at work and at home, reducing productivity, aggravating the need for sick leave and affecting leisure time. In turn, these factors contribute to health problems that are reflected in the general QoL and, by extension, at work.[5,6] The situation of the worker with disability is characterized by the need for constant effort and adaptation, since physical disability may be irreversible. Indeed, the work setting can worsen the condition, exacerbating difficulties in job performance and sometimes obliging the worker to take leave of absence or early

retirement.[7,8] The latest data from the US National Health Interview Survey show that 47.1% of American adults aged 18-64 years with disabilities are physically inactive, in comparison with only 26.1% of adults with no such disabilities. Moreover, inactive adults with disabilities are 50% more likely to report one or more chronic diseases compared to those who are physically active.[9]

Studies have reported that ergonomic inadequacies related to the biomechanical posture applied to perform work activities can provoke musculoskeletal injuries, thus increasing pain and morbidity.[1] Sub-optimum working conditions have also been related to low job satisfaction, high levels of emotional exhaustion, the development of occupational diseases and high rates of sick leave.[6] The physical environment of the workplace is an issue of major importance since a large proportion of a person's productive life is spent in this context. At present, the incorporation in the workplace of persons with physical disability is encouraged as a means of enabling them to acquire greater autonomy and productivity. However, to achieve these goals, employers must provide the basic conditions for such workers to develop their potential and to lead a fuller life.[10]

The work of rehabilitation professionals is usually focused on health promotion, disease prevention and the rehabilitation of clients who need to maintain or restore movement and functional capacity, whether or not they have a physical disability. Specifically, occupational physiotherapy addresses the prevention and treatment of chronic and degenerative diseases in workers, including repetitive strain injury and work-related musculoskeletal disorders. In order to conduct an appropriate rehabilitation intervention, an ergonomic and biomechanical analysis of the worker and the workplace should first be performed.[11] Moreover, the principles of therapeutic

exercise and the expected degree of recovery from physical disorder or discomfort should be taken into consideration.[12] Regarding workers with physical disability, it is important to determine the perception of their own situation. This is commonly done by means of a QoL evaluation. This assessment reflects the level of physical, mental, social and environmental functioning, including aspects such as relationships, perceptions of health, general satisfaction with life, overall well-being, needs, wishes and ambitions.[13,14] The worker's individual skills and the functional requirements of the job must also be analyzed to ensure that the latter do not exceed the individual's capabilities. In other words, the work demanded must be feasible and safe.[15-17]

The work ability and effectiveness of persons with disability is directly related to their physical and mental welfare.[17,18] Accordingly, workers' health status must be monitored, with particular attention to the critical aspects of the tasks required by the job that may prejudice the QOL and occupational health.[19] Therefore, longitudinal studies are needed to address and rectify these situations, or at least to prevent them from worsening. The efficacy results obtained from clinical trials could facilitate the design of rehabilitative strategies to enhance the QoL and personal resources of workers with physical disabilities. Accordingly, this pilot clinical trial had the following aims: 1) to evaluate the effectiveness of a program of ergonomic intervention, in which the workplace is adapted to the worker's needs and in which additional physical therapy is provided in accordance with the individual's abilities and limitations, with respect to the QoL and work ability/capacities of university workers with physical disabilities; 2) to estimate the sample size required for future randomized controlled trials with similar aims in workers with specific needs.

Method

Study design

A pilot intra-subject clinical trial with three-month follow-up was performed, based on the following within-subject repeated measures: pre-treatment/baseline, post-treatment (after three months of treatment) and follow-up (at three months after the conclusion of treatment).

Participants

The initial sample was composed of eleven workers (the total eligible population in the context of this study setting), who were fully informed about the study and who gave their written consent to take part. The participants were persons with physical disability, recruited at the Federal University of XX (XXX, Brazil). Finally, eight participants were included in the study. The participants were diagnosed with Cerebral Palsy (1), Polio (2), Lower-limb Impairments (3), Myelomeningocele (1), and Limb Amputation (1). The majority of them were single, higher education level and administrative assistants working eight hours a day. These persons received a 12-week ergonomic program consisting of a weekly ergonomic program together with weekly physiotherapy sessions.

Selection criteria

The following inclusion criteria were applied: 1) aged at least 18 years; 2) employed for at least one year in the university; 3) affected by a physical disability; 4) continuing in this employment during the study period.

The exclusion criteria were: 1) mental illness; 2) behavioral disorders; 3) drug abuse; 4) cognitive impairment; 5) severe physical disability; 6) illiteracy; 7) non-provision of informed consent to participate.

Ethical aspects

This study was approved by the Ethics Committee of the Federal University of XXX (XXX, Brazil), in accordance with Resolution 196/96, Protocol 0160/13, on research involving human subjects. All participants were properly informed and gave their written consent to participate in the study.

Outcome measures

Sociodemographic, occupational and clinical data were obtained for each participant. The measuring instruments used were the WHOQoL-Bref questionnaire [20] and the Work Ability Index.[21] Both instruments were applied to the three study periods: pre-treatment, post-treatment and follow up.

The World Health Organization Quality of Life Scale (WHOQoL-Bref) contains 26 questions that assess a person's quality of life and health-related satisfaction. This instrument has four subscales: physical, psychological, social relationships and environment. The answers are scored on a Likert scale from 1 to 5 points, where the higher the score, the better the quality of life. The raw score for each domain is used to calculate the transformed score.[20]

The Work Ability Index (WAI) includes a worker's self-assessment of health and capacity to work. It can be used by health services at the workplace, enabling early diagnosis of the loss of work ability. This instrument is also used in disease prevention and in programs to maintain and promote occupational health. The WAI is composed of seven elements, reflecting the physical and mental demands of the job, together with the worker's health status and capabilities. The score obtained for each item ranges from 1 to 7 points and the total score ranges from 7 to 49 points. A score of 7-27 points

corresponds to a low level of work capacity, one of 28-36 moderate capacity, 37 to 43 good capacity, and 44-49 excellent capacity.[21]

Intervention

The interventions were carried out by three physiotherapists, each of whom had over 10 years' experience in the treatment of physical disability clients. The intervention program was applied for 12 weeks, with 60-minute sessions provided twice weekly (24 sessions). The interventions were carried out at XXX Clinical School of Physiotherapy from XXX University of XXX (XXX, Brazil). The study subjects were workers with physical disabilities who took part in the intervention program, based on ergonomic adjustments in the workplace and customized physical therapy. The intervention program was divided into three main actions:

ErgoDis/IBV application: Firstly, we evaluated the work environment and the postures adopted by the workers in the performance of their activities. This tool includes direct and indirect observation by video recording that follows the checklist specified for this instrument. It also systematizes activities in accordance with possible adaptation solutions offered from a database contained in the software. Secondly, following the indications of the ErgoDis/IBV program, functional ergonomic adaptations were applied to the organization of the workplace. The ERGODIS-IBV method analyzes the work and the worker, following the analysis and treatment of the data and decisions on the case, based on the identification of the degree of adjustment or mismatch between the demands and the functional capacity of each worker. This method allows to evaluate and prevent the risks derived from the work activity, in order to avoid worsening physical disability and musculoskeletal pain. When analyzing the workplace, this method evaluates whether the design of the room or furniture are inadequate for each

person. According to the software, adjustment needs were identified on: 1) the height of the seat of the chair to adjust it to a correct angle of the knee, since everyone works using a computer; 2) use of backrest in the chair; 3) adjustment of the height of the computer screen; 4) increase the height of the table, so that the chair can be closer to the table; and 5) organization of objects on the table. We implemented adaptations such as including adjustments to the furniture modifying the office chair and replacing the desk to achieve a more appropriate height, as well as adjusting the monitor settings and the layout of other objects in the workplace, according to the worker's individual requirements. These changes were aimed at promoting greater efficiency and satisfaction in the activities performed at work, and at reducing levels of stress in daily occupational tasks.[22]

Body posture module: this part of the intervention program included body posture adjustments and recommendations offered by the XXX Posture School. This institution provides teaching methodologies to promote and achieve good posture in the activities of work and daily life, through healthy habits and anatomical knowledge of the factors that can provoke musculoskeletal pain. Firstly, each worker identified these factors in their work setting and their individual needs. Secondly, the participants were given an illustrated practical guide to maintain good posture in the workplace and during the activities of daily living.

Physical therapy intervention: the study sample received exercises based on kinesitherapy and hydrotherapy/balneotherapy. This intervention was initiated immediately after making the ergonomic adjustments in the workplace. Each session was structured as follows: firstly, warm-up exercises for general activation, with active mobilization of the upper and lower limbs (when possible) to prepare the body for

performing the exercises and to avoid the risk of injury. Then, kinesitherapy (passive and/or stretching, flexibility and muscle strength exercises) and hydrotherapy/balneotherapy were implemented. Finally, relaxation exercises based on an adaptation of the Jacobson technique were performed, to release tensions and to promote the further enrichment of body schema and awareness.[23]

Data analysis

The statistical analysis was conducted using the statistical program SPSS version 22.0. After a descriptive analysis of demographic and baseline clinical variables, the normal distribution of the variables was verified by the Kolmogorov-Smirnov test. A repeated-measures ANOVA was performed to determine the between-time effects (at baseline, immediately following the intervention and at three months after finishing the program). The analyses were focused on QoL (primary outcome) and work ability (secondary outcome). When the normality assumption was not met, changes in intra-group scores were measured using the Wilcoxon signed-rank test. The threshold for statistical significance was taken as $p<0.05$. The effect sizes were calculated using Cohen's *d* coefficient. An effect size of <0.2 reflected a non-significant difference, one between ≥ 0.2 and <0.5 a small difference, between ≥ 0.5 and <0.8 a moderate difference, and ≥ 0.8 a large difference.

Results

Participation

Eleven workers with disability initially participated in this clinical trial. After applying the selection criteria, eight were finally included in the intervention group (Fig. 1). These workers were predominantly female (75%), with a mean age of 40.50 years. Due to their physical limitations, 50% of the subjects needed specially adapted transport to

travel to and from the workplace. The sociodemographic, clinical and occupational characteristics of the participants are shown in Table 1.

[Table 1 near here]

Changes in Quality of Life and Work Ability

The repeated-measures ANOVA analysis reflected significant intra-group changes in the QoL subscales of physical dimension ($F = 5.487$, $p = 0.017$) and environment dimension ($F = 7.510$, $p = 0.006$). At post-treatment, significant changes were recorded for the physical dimension ($Z = -2.552$, $p = 0.011$) and the environment dimension ($Z = -2.201$, $p = 0.028$). However, after the three-month follow-up period, a significant change was observed only for the environment dimension ($Z = -1.965$, $p = 0.049$). The effect sizes were large. The within-group analysis showed no significant improvements from baseline values for the psychological and social relationships dimensions ($p>0.05$). Regarding work ability, the repeated-measures ANOVA analysis showed there was a significant time effect ($F = 5.067$, $p = 0.022$) and that the sample experienced a pre-post-treatment improvement ($Z = -2.555$, $p = 0.011$). The magnitude of the effect was large, with a Cohen d value of 0.914. Table 2 shows the intra-group pre-post-follow-up changes recorded and the associated effect sizes.

[Table 2 near here]

Sample size estimation for future studies

The pre-post-treatment improvement recorded, of 1.63 points (standardized mean difference) in the WHOQoL-Bref (physical subscale) as the primary outcome, is clinically relevant in the population considered in this clinical trial. We estimate that a sample size of 20 participants per arm would be needed to provide a confidence interval

of 95%, with a power of 80%, assuming a level of bilateral significance (α) of 0.05. In addition, the sample size should be increased to 22 participants in order to allow for a loss to follow-up of up to 10%.

Discussion

The main aim of this pilot clinical trial was to evaluate the effectiveness of an ergonomic program, in which the workplace was adapted to the worker's needs and in which additional physical therapy was provided in accordance with the individual's abilities and limitations, focused on the QoL and work ability/capacities of university workers with physical disabilities. The ergonomic intervention program, which was applied for three months, achieved significant changes in these persons' QoL and ability to work. Specifically, our results suggest that the program increased the levels of QoL in its physical and environment dimensions. Furthermore, a short-term improvement in the environment dimension was observed at three weeks after the intervention. These results indicate that the workers achieved a more effective management of their tasks, activities and assignments.

The score for the environment dimension of the QoL had increased considerably by the end of the three-month follow-up period. Therefore, a closer integration with the demands posed by the job seems to produce a beneficial effect on individuals with physical disabilities. In this respect, the ErgoDis/IBV program has previously proved its effectiveness in facilitating the evaluation and adaptation of the workplace and in detecting workers' individual needs.[24] In a study including industrial workers, the authors concluded that work ability is significantly associated with the perception of QoL and that this association seems to be strongest for the physical aspects of QoL.[25] Thus, the physical improvement achieved with the ergonomic

program could have influenced the workers' perceptions of their ability. A similar study evaluating effectiveness of a mixed intervention program including ergonomic advices and supervised exercises in a sample of hospital workers with persistent low back pain showed an improvement on pain and disability.[26] Another research evaluated the effects of ergonomic postures recommendations during work and activities of daily living, as well as a mobility training program in university professors, students and employees. These participants showed a reduction of pain intensity and low back functional disability in comparison with a control group.[27] To achieve further progress in this field, different strategies and resources should be implemented, carefully monitoring workers with physical disability. Such actions could enhance the work environment, making it more productive and minimizing the limitations caused by physical disability.[28]

Regarding work ability, application of the ergonomic and physiotherapy program improved the results of the workers' self-assessment of health and capacity to work. This clinical trial was implemented taking into account the principles reported in the systematic review conducted by Kuoppala and Lamminpää,[10] who emphasized the importance of including the workplace in the rehabilitation process, in order to increase the effectiveness of interventions. Another review identified physical and workplace aspects as factors that should be addressed to improve the occupational abilities of injured workers.[29] According to Rimmer and Lai,[30] specific strategies should be adopted to prevent muscle or skeletal disorders, with the promotion of regular physical activity and the provision of appropriate ergonomics in the workplace to minimise existing and newly acquired disabilities. In this respect, instead of increasing the intensity and/or frequency of rehabilitation treatment, future intervention programs should take into account the benefits of a biopsychosocial approach. In this line, too, a study of a

physical exercise training program combined with recommendations for leisure-time physical activity of moderate intensity reported significantly decreased occupational absenteeism in office workers.[31] A mobile-based intervention based on acceptance and commitment therapy has proven to be effective in increasing psychological flexibility related to work ability and perceived stress in individuals with symptoms of metabolic syndrome and psychological stress.[32] In a study enhancing the performance of individuals with severe multiple disabilities, the authors found that a shared-work program (sharing job duties with another worker based on respective skills and physical limitations) reduced need for assistance provided and increased supported work performance in several types of community jobs.[33] Finally, an occupational health intervention program has been shown to improve work ability and quality of life and to decrease levels of burnout in workers liable to seek early retirement.[34]

The present study has various limitations. Firstly, the clinical trial was conducted at a single higher education institution in the public sector. This issue could reduce generalization of the results or the external validity of the study. Multicenter studies should be undertaken to expand the study focus to include the general population with physical disability in the university context. In addition, this clinical trial only included an intervention group. We did not conduct a comparative study among workers with physical disabilities receiving the ergonomic program vs a control group. Hence, the results should be interpreted with caution. However, our findings do shed light on the question and can be of use in future investigation.

Conclusions

The results we present show that participation in an ergonomic intervention program by workers with physical disabilities is beneficial to their QoL and enhances

their job performance. Ergonomic adaptations in the workplace and the provision of physiotherapy treatment are effective when they take into account the specific needs of this population. This pilot clinical trial provides a basis for promoting new research and clinical initiatives in the university context.

Broader-based studies are now needed to examine the benefits obtained from new strategies aimed at preventing injuries in the workplace and at promoting the integration and welfare of workers with disabilities.

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References

1. Duran X, Martínez JM, Benavides FG. Occupational factors associated with the potential years of working life lost due to a non-work related permanent disability. *Work*. 2013;45(3):305–309. https://doi.org/10.3233/WOR-121522.
2. Mendes LF, Lancman S. Rehabilitation of patients with LER / DORT: contributions of physiotherapy group. *Re Bras Saúde Ocup*. 2010;35(121):23–32. http://dx.doi.org/10.1590/S0303-76572010000100004.
3. Hamdani Y, Mistry B, Gibson BE. Transitioning to adulthood with a progressive condition: best practice assumptions and individual experiences of young men with Duchenne Muscular Dystrophy. *Disabil Rehabil*. 2015;37(13):1144–1151. http://dx.doi.org/10.3109/09638288.2014.956187.

4. Widerström-Noga EG, Finnerup NB, Siddall PJ. Biopsychosocial perspective on a mechanisms-based approach to assessment and treatment of pain following Spinal Cord Injury. *J Rehabil Res Dev*. 2009;46(1):1–12.
5. Pinto GMC, Pedroso B, Pilatti LA. Qualidade de vida no trabalho de servidores públicos do setor administrativo de uma instituição de ensino superior do Paraná [Quality of life and quality of working life of public servants in the administrative sector of an upper Paraná educational institution]. *R Bras Qual Vida*. 2014;6:174–183. http://dx.doi.org/10.3895/S2175-08582014000300003.
6. Maier RC, Santos JG, Timossi LS. Análise das influencias existentes entre qualidade de vida e qualidade de vida no trabalho: estudo com colaboradores da industria de Laticínios [Analysis of existing influences between quality of life and quality of life at work: study with dairy industry employees]. *Revista Gestão Industrial*. 2012;8(2):265–280. http://dx.doi.org/10.3895/S1808-04482012000200011.
7. Veltrone AA, Almeida MA. Perfil da pessoa com deficiência no mercado de trabalho na cidade de São Carlos-SP [Profile of persons with disabilities in the labor market in the city of São Carlos, Brazil]. *Rev Educ Spec*. 2010;23(36):73–90. http://dx.doi.org/10.5902/1984686X1434.
8. Barduzzi GO, Júnior PRR, Neto JCS, Aveiro MC. Capacidade funcional de idosos com osteoartrite submetidos a fisioterapia aquática e terrestre [Functional capacity of older adults with osteoarthritis undergoing aquatic and terrestrial physiotherapy]. *Rev Fisioter Mov*. 2013;2(26):349–360. http://dx.doi.org/10.1590/S0103-51502013000200012.
9. Lin JH, Ju YH, Lee SJ, Yang YH, Lo SK. Examining changes in self-perceived quality of life in children and adolescents with physical disability using a

longitudinal design. *Disabil Rehabil*. 2011;33(19-20):1873–1879. http://dx.doi.org/10.3109/09638288.2011.552664.

10. Kuoppala J, Lamminpää A. Rehabilitation and work ability: A systematic literature review. *J Rehabil Med*. 2008;40(10):796–804. http://dx.doi.org/10.2340/16501977-0270.
11. Matsugaki R, Kuhara S, Saeki S, Jiang Y, Michishita R, Ohta M, Yamato H. Effectiveness of workplace exercise supervised by a physical therapist among nurses conducting shift work: A randomized controlled trial. *J Occup Health*. 2017;59(4):327–335. http://dx.doi.org/10.1539/joh.16-0125-OA.
12. Moreira KL, Ábalos-Medina GM, Villaverde-Gutiérrez C, de Lucena NM, de Oliveira AB, Pérez-Mármol JM. Effectiveness of two home ergonomic programs in reducing pain and enhancing quality of life in informal caregivers of post-stroke patients: A pilot randomized controlled clinical trial. *Disabil Health J*. 2018; S1936-6574(18)30004–30009. https://doi.org/10.1016/j.dhjo.2018.01.003.
13. Taylor WJ, Myers J, Simpson RT, McPherson KM, Weatherall M. Quality of life of people with rheumatoid arthritis as measured by the World Health Organization Quality of Life Instrument, Short Form (WHOQOL□BREF): Score distributions and psychometric properties. *Arthritis Care Res*. 2004;51(3):350–357. https://doi.org/10.1002/art.20398.
14. Vasconcelos FD. O trabalhador com deficiência e as práticas de inclusão no mercado de trabalho de Salvador, Bahia [The worker with disabilities and inclusion practices in the labor market of Salvador, Bahia]. *RBSO*. 2010;35(121):41–52. http://dx.doi.org/10.1590/S0303-76572010000100006.

15. Fisher GG, Chaffee DS, Tetrick LE, Davalos DB, Potter GG. Cognitive functioning, aging, and work: A review and recommendations for research and practice. *J Occup Health Psychol*. 2017;22(3): 314–336. http://dx.doi.org/10.1037/ocp0000086.

16. Maenner MJ, Smith LE, Hong J, Makuch R, Greenberg JS, Mailick MR. Evaluation of an activities of daily living scale for adolescents and adults with developmental disabilities. *Disabil Health J*. 2013;6(1):8–17. http://dx.doi.org/10.1016/j.dhjo.2012.08.005.

17. Shain M, Kramer DM. Health promotion in the workplace: framing the concept; reviewing the evidence. *J Occup Environ Med*. 2004;61(7):643–648. http://dx.doi.org/10.1136/oem.2004.013193.

18. Linton SJ, Boersma K, Jansson M, Svärd L, Botvalde M. The effects of cognitive-behavioral and physical therapy preventive interventions on pain-related sick leave: a randomized controlled trial. *Clin J Pain*. 2005;21(2):109–119.

19. Pessoa Jda C, Cardia MC, Santos ML. Análise das limitações, estratégias e perspectivas dos trabalhadores com LER/DORT, participantes do grupo PROFIT-LER: um estudo de caso [Analysis of the limitations, strategies and perspectives of the workers with RSI/WRMD, participants of the PROFIT-LER Group: a case study]. *Cien Saude Colet*. 2010;15(3):821–830. http://dx.doi.org/10.1590/S1413-81232010000300025.

20. Fleck MP, Louzada S, Xavier M, et al. Application of the Portuguese version of the abbreviated instrument of quality of life WHOQOL-bref. *Rev Saude Publica*. 2000;34(2):178–183. http://dx.doi.org/10.1590/S0034-89102000000200012.

21. Martínez MC, Latorre MR, Fischer FM. Validity and reliability of the Brazilian version of the Work Ability Index questionnaire. *Rev Saude Pública*. 2009;43(3):525–532. http://dx.doi.org/10.1590/S0034-89102009005000017.

22. Tortosa L, Ferreras A, García-Molina C, Chirivella C, Page A. *IBV. ErgoDis/IBV. Método de adaptación ergonómica de puestos de trabajo para personas con discapacidad. Manual de uso* [ErgoDis / IBV. Method of ergonomic adaptation of jobs for people with disabilities. User's manual] Valencia (Spain): Instituto de Biomecánica de Valencia (IBV). 1999.

23. Rodrigues AC. *Reabilitação: práticas inclusivas e estratégias para a ação* [Rehabilitation: inclusive practices and strategies for action]. Andreoli. 2008.

24. Martins LB, Cabral AK. Ergonomics and the inclusion of disabled people in the Brazilian job market. *Work*. 2012;41(Supplement 1):5493–5499. http://dx.doi.org/10.3233/WOR-2012-0863-5493.

25. Bagalhi CT and Alqualo-Costa R. Prevalência de distúrbios osteomusculares relacionados ao trabalho em fisioterapeutas [Prevalence of work-related musculoskeletal disorders in physical therapists]. *Lect Educ Fís Deportes (B. Aires)*. 2011;2(2):93–102.

26. Pillastrini P, Bonfiglioli R, Banchelli F, et al. The effect of a multimodal group programme in hospital workers with persistent low back pain: a prospective observational study. *Med Lav*. 2013;104(5):380-392.

27. Lima VP, de Alkmim Moreira Nunes R, da Silva JB, et al. Pain perception and low back pain functional disability after a 10-week core and mobility training program: A pilot study. *J Back Musculoskelet Rehabil*. 2018; In press:1-7. https://doi.org/10.3233/BMR-169739.

28. Santos AC, Bredemeier M, Rosa KF, Amantéa VA, Xavier RM. Impact on the Quality of Life of an Educational Program for the Prevention of Work-Related Musculoskeletal Disorders: a randomized controlled trial. *BMC Public Health*. 2011;11(1):60. https://doi.org/10.1186/1471-2458-11-60.

29. Fadyl JK, McPherson KM, Schlüter PJ, Turner-Stokes L. Factors contributing to work-ability for injured workers: literature review and comparison with available measures. *Disabil Rehabil*. 2010;32(14):1173–1183. https://doi.org/10.3109/09638281003653302.

30. Rimmer J, Lai B. Framing new pathways in transformative exercise for individuals with existing and newly acquired disability. *Disabil Rehabil*. 2017;39(2):173–180. https://doi.org/10.3109/09638288.2015.1047967.

31. Justesen JB, Søgaard K, Dalager T, Christensen JR, Sjøgaard G. The effect of Intelligent Physical Exercise Training on sickness presenteeism and absenteeism among office workers. *J Occup Environ Med*. 2017;59(10):942–948. https://doi.org/10.1097/JOM.0000000000001101.

32. Luodelahti M. *Mobile-based intervention based on acceptance and commitment therapy: the effectiveness on work ability and perceived stress for individuals with symptoms of metabolic syndrome and psychological stress*. University of Jyväskylä. 2015

33. Parsons MB, Reid DH, Green CW, Browning LB, Hensley MB. Evaluation of a shared-work program for reducing assistance provided to supported workers with severe multiple disabilities. *Res Dev Disabil*. 2002;23(1):1-6. https://doi.org/10.1016/S0891-4222(01)00088-9.

34. De Boer AG, Van Beek JC, Durinck J, Verbeek JH, Van Dijk FJ. An occupational health intervention programme for workers at risk for early

retirement; a randomised controlled trial. *J Occup Environ Med*. 2004;61(11):924–929. https://doi.org/10.1136/oem.2003.009746.

Figure captions

Figure 1. Study design and flow of participants through the trial following CONSORT guidelines.

Table 1

Mean ± SD and inter-group differences at baseline in the sociodemographic, job and clinical characteristics of workers with disability.

Sociodemographic characteristics	**Mean / Absolute frequency (n)**	**SD / %**
Age (years)	40.50	11.14
Sex		
Female	6	75%
Male	2	25%
Marital status		
Single	6	75%
Married	1	12.5%
Divorced	1	12.5%
Widowed	0	0%
Education		
No formal education	0	0%
Primary (incomplete)	1	12.5%
Primary (complete)	2	25%
Secondary (incomplete)	0	0%
Secondary (complete)	1	12.5%
Higher education	4	50%
Occupational Characteristics	**Absolute frequency (n)**	**%**
Type of transport used		
Adapted car	4	50%
Non-adapted car	2	25%
Public transport	2	25%
Work value		
Important	5	62.5%
Monotonous	1	12.5%
Pleasurable	2	25%
State after work		

Tired	2	25%
Unwell	1	12.5%
No complaints	5	62.5%
Work function		
Administrative assistant	4	50%
Nurse	2	25%
Computer technician	1	12.5%
Laboratory technician	1	12.5%
Work hours		
12 hours a day	1	12.5%
8 hours a day	3	37.5%
6 hours a day	4	50%
Absenteeism*	2	25%

Clinical Characteristics	**Absolute frequency (n)**	**%**
Use of orthosis		
Stick	2	25%
Wheelchair	2	25%
Crutches	1	12.5%
None	3	37.5%
Oedema*	6	75%
Headache*	3	37.5%

SD: Standard Deviation; * Absolute value and percentage of people answering “Yes”.

Table 2

Baseline, post-treatment, follow-up, and pre-follow-up differences (95% CI) and sample size for Quality-of-Life and work ability.

Outcome measure/Domain	Pre-treatment Mean±SD	Post- treatment (three-months) Mean±SD	Follow-up (three-months) Mean±SD	*p* (pre-post)	Cohen *d* (pre-post)	*p* (pre-follow-up)	Cohen *d* (pre-follow-up)
WHOQoL-Bref							
Physical	51.31±5.07	58.93±4.27	54.46±5.65	0.011*	1.630	0.518	0.533
Psychological	54.69±8.46	60.42±8.33	56.77±5.43	0.105	0.683	0.357	0.293
Social relationships	62.49±10.91	67.71±9.38	67.71±9.38	0.102	0.513	0.131	0.513
Environment	55.85±9.06	68.36±7.74	64.89±6.60	0.028*	1.485	0.049*	1.141
WAI	37.5±3.66	40.75±3.45	36.38±3.40	0.011*	0.914	0.624	0.317

* $p<0.05$

SD: Standard Deviation; WHOQoL-Bref: World Health Organization Quality-of-Life Scale; WAI: Work Ability Index