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Improve Pain and Sleep in a Demented Elder with Osteoarthritis: A Case Report Study in Iran

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Abstract: Osteoarthritis (OA) of the knee which is prevalent among older adults in nursing homes, causes significant pain and suffering including disturbance of nocturnal sleep. One nonpharmacologic treatment option is quadriceps-strengthening exercise, however the feasibility of such a treatment for reducing pain from OA in severely demented elders has not been studied. This study describes the test of the feasibility of such an exercise program, together with its effects on pain and sleep in a severely demented nursing home resident. The subject was an elderly man with severe cognitive impairment (Mini-Mental Status Exam score 4) and knee OA (Kellgren-Lawrence radiographic grade 4). He was enrolled in 5 weeks, 10 session standardized progressive-resistance training program to strengthen the quadriceps and completed all sessions. Pain was assessed with the Western Ontario and MacMaster OA Index (WOMAC) pain subscale and sleep was assessed by actigraphy. The patient was able to perform the exercises with a revision to the protocol. However, the WOMAC OA pain subscale proved inadequate for measuring pain in a patient with low cognitive functioning and therefore, the effects on pain were inconclusive. Although, his sleep improved after the intervention, the influence of his medications and the amount of daytime sleep on his nighttime sleep need to be considered. A quadriceps-strengthening exercise program for treating OA of the knee is feasible in severely demented elders, although a better outcome measure is needed for pain.

Key words: Osteoarthritis, nursing home, WOMAC, exercise program, Iran

INTRODUCTION

Osteoarthritis (OA) is a highly prevalent, disabling condition afflicting 16 million older adults in the Iran (American College of Rheumatology, 1997). Nearly 70% of the elderly population show radiographic evidence of OA (Lawrence *et al*., 1989) and the prevalence of OA increases with age (Hamerman, 1995). Chronic pain and suffering from OA account for $15.5 billion annually (in 1994 dollars) in health care expenditures (Yelin, 1998) and among all the potentially painful disorders in older persons, OA accounts for the greatest proportion of pain complaints (Sternbach, 1986). Pain is an important predictor of functional limitation in persons with OA of the knee (Hochberg *et al*., 1989).

Some 45-65% of elderly nursing home residents suffer from OA (Marzinski, 1991; Ferrell *et al*., 1990). The knee is one of the most commonly affected sites (O'Reilly *et al*., 1998). Undertreatment of pain in nursing home residents has serious consequences for the quality of their sleep (Ross and Crook, 1998) and the combination of unrelieved pain and sleep disturbance further exacerbates existing cognitive impairment (Duggleby and Lander, 1994) and leads to depression (Cohen-Mansfield and Marx, 1993) and disruptive behavior (Ryden *et al*., 1991) while also increasing the considerable burden and costs of caring for elders.

Treatment options for frail nursing home residents with OA are limited. Nursing home residents tend to be in poorer overall condition than their counterparts dwelling in the community and pharmacologic intervention tends to exacerbate their already frail physical condition. An intervention that is easy to administer and has few side effects is thus, needed for nursing home residents. One treatment option is an exercise program.

Recently, attention has focused on the quadriceps in the treatment of knee OA pain. The quadriceps mechanism is of key importance for walking, standing and using stairs and weakness in this muscle may cause impaired function. In addition, quadriceps weakness is a primary risk factor for progression of joint damage in knee OA and knee pain (O'Reilly *et al*., 1998; Slemenda *et al*., 1997). Slemenda *et al*. (1998) found that less quadriceps strength predicted both radiographic and symptomatic knee OA. The odds ratio for the presence of OA per 10-l b ft loss of strength was 0.8 for radiographic OA and

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it was 7.1 for symptomatic OA, indicating that persons with symptomatic OA had weaker quadriceps than those with asymptomatic OA. Further, O'Reilly *et al.* (1998) found that quadriceps weakness was strongly associated with pain in 600 community-dwelling individuals ages 40-79 with knee OA (O'Reilly *et al*., 1998). Subjects with knee pain had less voluntary quadriceps strength than those without pain ($t = 3.90$, $p<0.01$). Quadriceps strength (Odds ratio = 18.8 for muscle strength ≤10 kgF) and radiographic change (Odds ratio = 4.1 for radiographic score ≥4) are thus independently associated with knee pain.

Exercise has been found to be an effective and well-tolerated treatment for knee OA (Maurer *et al*., 1999; Ettinger *et al*., 1997). Examining the effect of quadriceps exercise on knee OA in 113 subjects ages 50-80, Maurer *et al*. (1999) found that both exercise and an educational intervention effected an overall improvement ($p<0.05$). Patients in the exercise group, however had a greater decrease in pain than those receiving an educational intervention ($p<0.01$ for pain change; $p<0.05$ for stair-associated pain at week 8). Similarly, Ettinger *et al*. (1997), working with 365 subjects age 60 or older, reported an 8% lower pain score for the quadriceps exercise group than the educational-intervention group ($p<0.05$).

Exercise in general is beneficial for nursing home residents with OA pain and disability. However, the feasibility of using a quadriceps-strengthening program for severely demented nursing home residents has not been tested. This study describes the experience with a severely demented nursing home resident, the effects of quadriceps strengthening on his pain and sleep and the implications of the experience for such an exercise program with this population.

CASE PRESENTATION

Mr. T, a pleasant 80 years old veteran was chosen to participate in the exercise program. His medical diagnosis included dementia with delusional features, osteoarthritis, depression, anemia, gout, cataracts and orthostatic hypotension. He was Farsi-speaking, had a Mini-Mental Status Exam score of 4, had radiographic evidence of knee OA (Kellgren-Lawrence grade of 4 in both knees) and was ambulatory without assistance.

He was identified by nursing staff as having knee pain. Both he and his daughter provided consent for him to participate in the program. Researchers collected information about his pain using the Western Ontario and MacMaster OA Index (WOMAC) pain subscale and minutes of nighttime sleep were measured by actigraphy. Pain assessment occurred between 3:00 p.m. and 5:00 p.m. on days 1, 3 and 5 of baseline and days 16, 18, 20, 31, 33 and 35 of the intervention. Sleep assessment occurred on days 1-5 of baseline and days 16-20 and 31-35 of the intervention. These assessments were performed by the first researcher and a research assistant who was enrolled in a master's-level nurse practitioner program at the time of the study. Use of analgesic medications and medications that might affect sleep were recorded throughout the study period.

The 5 weeks quadriceps-strengthening exercise program involved standardized progressive-resistance training. After 5 min of warm-up, Mr. T performed knee extensions using Keiser knee-extension equipment. The exercise protocol included 10 sessions that required the elder to lift and lower the training loads separately for each leg to equalize the relative training stimulus for each limb. Mr. T performed three sets of eight repetitions on 2 non-sequential days/week for 5 weeks. His training loads began at 50% of his predetermined 1 Repetition Maximum (1RM) and should gradually progress to heavier loads which were decided based on Mr. T's tolerance of training loads and whether he showed any pain behaviors such as refusing to exercise, guarding or rubbing the knee, showing nonverbal vocalizations (sighs, gasps, moans, groans and cries) and facial grimacing or wincing and expressing vocal complaints (in words expressing discomfort or pain). All sessions were conducted with supervision to ensure safety and proper technique. A cool-down period of 5 min followed each exercise session. Mr. T completed all 10 quadriceps-strengthening exercise sessions.

At the pre-test, his 1RM was 45 lb for both legs which is similar to the average for osteoarthritic male elders (Brandt *et al*., 1999) and is weaker than elders without OA (Trappe *et al*., 2002). We started with an average of 20 lb of resistance at the beginning of the program and maintained it throughout the intervention. The time required to complete a set of exercises varied depending on Mr. T's cognitive functioning on that day. At the beginning of the exercise intervention, it took an average of 3-4 min to complete a set because we needed to coach or help the confused elder do the exercise. By the end of the exercise intervention, it took <1 min for him to perform a set of exercises. Although, we tried not to have a rest period between sets, we had no control over this. It depended on the cognitive functioning of Mr. T on that specific day.

After completing 10 sessions of exercises, his WOMAC pain score dropped from 3 at the pre-test to 0, indicating decreased pain. His night-time sleep also improved, increasing from 271 min at the pre-test to

474 min after the intervention. In addition, his Mini-Mental Status Exam score increased from 4-7. He remained ambulatory without assistance. His nutrition and appetite remained unchanged throughout the study period. The amount of anticonvulsant (valproic acid) that Mr. T was given increased from 350-500 mg during the last week of the intervention. In addition, his intake of antipsychotic (risperidone) increased from 0.65-1 mg after the 2nd week of the intervention while the amount of analgesic remained almost the same. Changes in his pain score, sleep and use of medications are shown in Fig. 1.

Because of his low cognitive functioning, during the 1st 2 weeks of the intervention, Mr. T could not understand the command for him to do each step of the exercise. Researchers had to use the hands to nudge or touch his leg to give him a hint and on occasion we lifted and lowered his legs for him. By the 3rd week of the intervention however, we saw a learning effect: Mr. T recognized the name of the machine (Keiser), pronouncing it every time we took him to the exercise laboratory and he was able to sit on the machine by himself and perform the exercise almost without help. Throughout the exercise program, however he could not exercise each leg separately.

The validity of self-reports of pain by elders with low cognitive functioning such as Mr. T, is questionable. We had to keep asking the same questions over and over and it was difficult to keep him focused on them. In addition, we had to ask the pain questions immediately after he performed each activity (walking, sitting, lying down, standing) because he could not remember what had happened more than a few minutes. When we asked the same questions on the WOMAC pain scale 5 min apart, he could not repeat the answers which indicates poor test-retest reliability and questionable validity with the cognitively impaired.

Since, the WOMAC pain scale is inadequate for elders with low cognitive functioning, alternative pain measures are needed. A possible alternative is assessment of activity level. We noted that Mr. T was usually very active and had good mobility but when he suffered from pain in the lower extremities, he avoided activities (e.g., standing up, walking) or refused to do exercises. On day 2 of the intervention, we saw him sit in a chair which was unusual; he then refused to stand up and pointed to his knee, saying, It hurts. We stopped the intervention for that day and did it another day. Although, Mr. T was able to communicate his pain on this occasion, often he could not do so. However, an unusual activity level in itself may be an indicator of pain in demented elders with OA of the lower extremities.

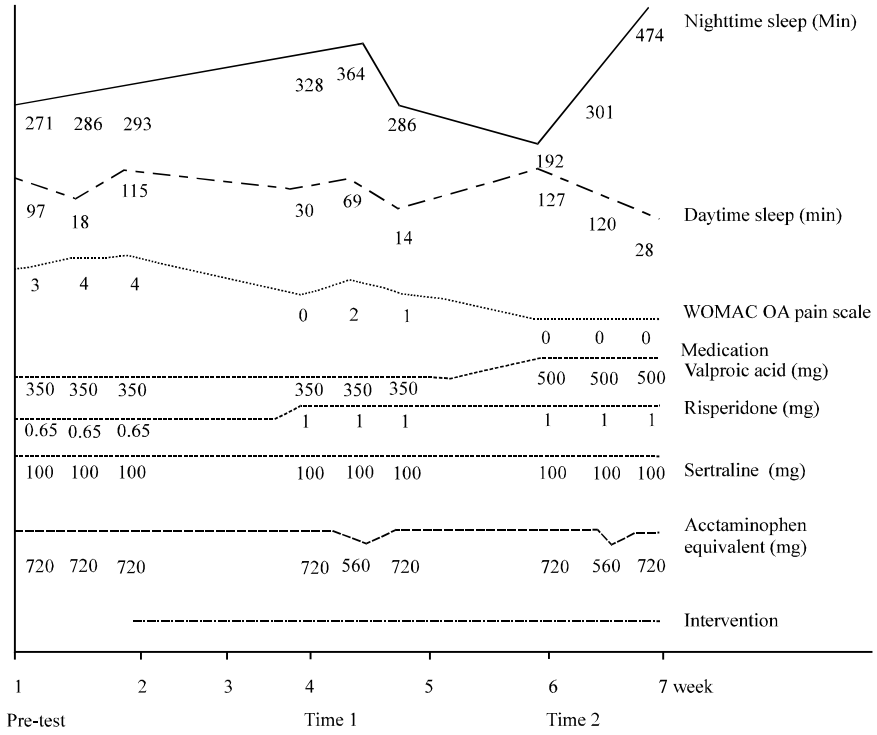

Fig. 1: The outcomes and use of medications throughout the research

Mr. T tolerated the actigraph well. He was curious about the wristwatch-like device secured to his wrist with a strip, touching it and playing with it. He kept the actigraph on his wrist for the required measurement period. Although, his sleep improved, his medications (valproic acid and risperidone) may have influenced his sleep (Fig. 1). Future study needs to control for the use of medications, if possible. We also suspected that the total minutes of daytime sleep may have been associated with sleep time during the night (Fig. 1). During the last week of the intervention, Mr. T slept about 127 min during the day which may have contributed to lack of sleep during the night (192 min). On day 3 of the last week of intervention, Mr. T slept only 28 min during the day and this may have contributed to the greater amount of night time sleep.

CONCLUSION

Even with severe cognitive impairment, Mr. T was able to perform the quadriceps-strengthening exercises. The exercise program however, needs to be adapted to an individual's level of cognitive functioning (e.g., using both legs simultaneously in the exercise instead of each leg alternately). The pain subscale of the WOMAC OA Index is inadequate for measuring pain in elders with low cognitive functioning who have difficulty communicating pain. In addition, the reliability and validity of self-reports of pain by these elders are questionable. It is necessary to find an alternative means of assessing pain in this population. Although, Mr. T's sleep improved after the intervention, the influence of medications and the amount of daytime sleep need to be considered. The actigraph appeared to be well tolerated and is an appropriate device for measuring the sleep of demented elders.

In this study, a quadriceps-strengthening exercise program for treating OA of the knee is feasible with severely demented elders. However, such an exercise program is labor intensive and an expensive intervention because severely demented elders will need to be closely supervised by the staff. With the shortage of nursing staffs, many nursing homes may not have the capacity to implement the entire exercise program. We learned from this project that severely demented elders are able to learn, able to follow directions and able to participate in an exercise program.

RECOMMENDATIONS

Researchers suggest modifying the exercise program to make it a group activity and teach demented elders with OA of the knee to perform leg-extension exercises without an exercise machine. Further investigation will be needed to determine the effects of a modified exercise program and a better measure of pain is needed.

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