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CASE REPORT

Physical therapy for nocturnal lower limb cramping: A case report

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ABSTRACT
Background and Purpose: Nocturnal lower limb cramps are sudden, intensely painful, and can decrease sleep, increase anxiety, and reduce quality of life. The purpose of this case report is to describe the effectiveness of an evidence-based physical therapy intervention for a person with lower limb cramps. ***Case Description***: The patient was a 34-year-old female who presented with idiopathic bilateral lower limb foot pain and cramps. ***Intervention***: Rehabilitation addressed muscle strength, joint mobility, soft tissue extensibility, and biomechanical influences during functional movement, for a total of seven sessions over seven weeks. ***Outcomes***: The frequency and severity of cramps decreased from three to four times/night, lasting several minutes down to one episode/week, lasting less than a minute. Her Numeric Pain Rating Scale (NPRS) score at worst decreased from 6/10 at the initial examination to 0/10 upon discharge. Lower extremity strength and functional mobility outcomes also exhibited improvement over the course of care. The patient's Lower Extremity Functional Scale (LEFS) score decreased from 87.5% to 80.0%, indicating greater disability, though this did not reach minimal detectable change levels. ***Discussion***: While her cramping and resulting pain improved, perceived participation restrictions persisted. Lack of improvement in the participation measure may have been related to the lack of a structured biopsychosocial approach to the rehabilitation process.

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Introduction

Nocturnal muscle cramps are sudden, intensely painful, sustained, involuntary, episodic contractions of skeletal muscle occurring primarily during sleep (Blyton, Chuter, Walter, and Burns, 2012; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010). Broadly defined, cramps are contractions of muscles brought about by sustained recruitment of motor units and may occur when a maximally contracted muscle is stimulated and then shortened beyond physiologic tolerance (Monderer, Wu, and Thorpy, 2010). They are characterized electrically by repetitive firing of motor unit action potentials at high rates of up to 150 per second (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). This is more than four times the normal rate in a maximal voluntary contraction The cramps can be sharp and excruciatingly painful, and may last from a few seconds to several minutes (Blyton, Chuter, Walter, and Burns, 2012; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010). After the initial cramp, the individual can experience muscle damage known as delayed onset of muscle soreness (DOMS), such that pain and tenderness may last for up to 2 weeks (Blyton, Chuter, Walter, and Burns, 2012). For patients who experience frequent nocturnal lower limb cramps, these painful episodes can awaken the patient from sleep, delay subsequent return to sleep, cause substantial distress, reduce quality of life, and limit sports participation and performance (Blyton, Chuter, Walter, and Burns, 2012; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010)

Though the majority of nocturnal cramps occur at night, they may occur at any time. Seventy-three percent of patients experience cramps exclusively at night, 20% experience cramps during the day and night, and 7% experience only daytime cramps (Monderer, Wu, and Thorpy, 2010). Additionally, 40% of patients experience cramps up to three times per week, whereas 6% of patients experience cramps daily.

Despite the high incidence, the etiology of nocturnal lower limb cramps appears to be largely idiopathic and the pathophysiology is not clearly understood. Proposed mechanisms have included physiologic, neurologic, endocrine, metabolic, vascular, pharmacologic, toxic, and congenital conditions. The cramps have been observed during all sleep stages and cannot be

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attributed to physiologic changes occurring during a specific sleep stage (Monderer, Wu, and Thorpy, 2010).

The diagnostic criteria for sleep-related leg cramps put forth by the American Academy of Sleep Medicine (Monderer, Wu, and Thorpy, 2010) are as follows: 1) a painful sensation in the leg or foot is associated with sudden muscle hardness or tightness, indicating a strong muscle contraction; 2) the painful muscle contractions in the legs or feet occur during the sleep period, although they may arise from either wakefulness or sleep; 3) the pain is relieved by forceful stretching of the affected muscles, releasing the contraction; and 4) the sleep-related leg cramps are not better explained by another current sleep disorder, medical or neurologic disorder, medication use, or substance use disorder.

Additionally, it is also important to conduct a differential diagnosis by ruling out the following similar conditions: restless leg syndrome (RLS), periodic limb movements, peripheral vascular disease, peripheral neuropathy, or dystonia. As compared to nocturnal lower limb cramps, RLS is characterized by continuous discomfort and the urge to move the legs is relieved by movement. They recur at brief intervals and are not associated with the muscle hardening, pain, or the need for forceful stretching as seen with nocturnal lower limb cramps. Peripheral vascular disease may lead to decreased peripheral pulses and lower extremity claudication. This tends to occur during limb use and in contrast to nocturnal cramps, is typically relieved by rest. Peripheral neuropathy may lead to muscle cramps secondary to nerve damage or muscle pathology. However, peripheral neuropathy also typically presents with other sensory or motor findings. Dystonia is typically a result of neurological disease and may present as muscle cramps due to the abnormal muscle spasms and posture. In contrast however, nocturnal lower limb cramps do not involve agonist and antagonist muscle co-contraction (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010).

Current interventions for nocturnal leg cramps have been classified as pharmacologic or non-pharmacologic treatments. Of the common pharmacologic interventions, only quinine and hydroquinine have been shown to be moderately effective (Blyton, Chuter, Walter, and Burns, 2012). However, there are significant side effects, including: thrombocytopenia, hepatitis, high blood pressure, tinnitus, severe skin rash, and haemolytic uremic syndrome (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). Non-pharmacologic interventions have included muscle stretching, massage, relaxation, sensory nerve stimulation, footwear changes, weight loss, physical exercise, avoiding physical fatigue, heat therapy, compression garments, night ankle dorsiflexion splints, placebo, reassurance, and changes to sleeping-sitting positions (Blyton, Chuter, Walter, and Burns, 2012). Specifically, muscle stretching is easy, low risk, and provides pain relief (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). Furthermore, it has a biopsychosocial impact as it provides patients with a behavioral strategy to influence their well-being, which in turn impacts their attitude toward recovery (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012).

The purpose of this case report is to describe the effect of potential contributing factors and non-pharmacologic interventions in the treatment of a patient experiencing nocturnal lower limb cramps. Interventions included many of those specified in the literature, including muscle stretching, soft tissue massage, and strengthening. Pharmocologic interventions were avoided because of the known side effects. This case report was approved by the institutional review board at the authors' affiliating institution; the patient provided informed, written consent.

Case Description

The individual in this case report was a 34-year-old female who presented to outpatient physical therapy with idiopathic bilateral lower limb foot pain and cramps with progressively worsening symptoms. She began experiencing pain for six months prior to the initial examination. The primary symptoms included severe, nocturnal bilateral foot, and right calf muscle cramping. The cramping had become progressively worse such that the frequency had increased to multiple times per night, each night, for the past 2 months. As a result, she had difficulty sleeping and had increased anxiety and distress resulting from these episodes. Additionally, her daily recreational and occupational activities began to provoke symptoms during the day, which had been limiting her participation in those activities and leading to further anxiety. Easing factors included massage to ease the cramping and standing/walking to minimize the onset during the day. Aggravating factors included: running, walking her dog; sleeping, and transitional activities such as coming from sitting to standing following prolonged sitting. She had not been running for the past 2 months secondary to symptom provocation. Current job duties required both desk and physically demanding work involving a significant amount of walking. This had exacerbated symptoms of foot cramping and pain during the workday.

Her physician recommended icing, NSAIDs, a foot compression sleeve, custom shoe orthotic inserts, and physical therapy. She did not have any imaging taken. She had not been taking any medications. Her past medical history included migraines, which she had learned to manage. She was not pregnant nor had she been pregnant within the past three years. Per her physician, she had no other co-morbidities or medical conditions, including any predisposing neurologic, endocrine, metabolic, vascular, pharmacologic, toxic, or congenital conditions. This was the patient's first experience with physical therapy. The patient's goals were to sleep through the night without lower limb cramps and to be able to run and walk without an onset of cramps during the day.

Initial examination

The initial examination consisted of a systems review, anthropometric measurements, postural and gait analyses, range of motion and strength examinations, special testing, and the administration of outcome measures. The systems review assessed several of the predisposing factors for nocturnal lower limb cramps: blood pressure, knee and ankle jerk reflex testing, lower extremity pulses including the popliteal, posterior tibialis, and dorsalis pedis pulses, sensation via bilateral dermatomal testing, and lower extremity proprioceptive assessment. The degree of arch pronation and lower limb/foot mechanics during gait was observed. Anthropometric assessment included height, weight, and BMI. A gross screen of passive and active range of motion of bilateral lower extremities was performed in sitting (Norkin and White, 2009). Strength assessment of major lower extremity muscle groups was assessed via manual muscle testing (Hislop and Avers, 2014). Special tests included the Single Leg Squat (SLS) Test (Mauntel et al., 2013) and the 30-second Sit-to-Stand Test (Jones, Rikli, and Beam, 1999). The patient's reported pain levels were assessed via the Numeric Pain Rating Scale (NPRS) (Stratford and Spadoni, 2001) and her functional mobility was assessed via the Lower Extremity Functional Scale (LEFS) (Binkley, Stratford, Lott, and Riddle, 1999).

The Single Leg Squat Test is a clinical movement screen that is useful to identify poor movement patterns and assess the risk for injury (Mauntel et al., 2013). Based on the study by Mauntel et al. (2013), knee valgus or medial knee displacement exhibited during a SLS may be influenced by decreased co-activation of the gluteal to the hip adductor muscles and restricted ankle dorsiflexion.

The 30-second Sit-to-Stand Test is a measurement to assess dynamic balance control, functional mobility, and lower extremity strength (Jones, Rikli, and Beam, 1999). The patient is instructed to rise to a full stand and return to the initial seated position as many times as possible within 30 seconds. This involves recording the number of stands a person can complete rather than the amount of time to complete a pre-determined number of repetitions, as in the Five Times Sit-to-Stand test. This increases the possibility of assessing a wide variety of ability levels (Jones, Rikli, and Beam, 1999).

The Lower Extremity Functional Scale (LEFS) is a patient questionnaire containing 20 questions assessing the patient's ability to perform everyday activities. The LEFS can be used as a measure of a patient's initial function, ongoing progress and outcome, as well as to set functional goals. The test can be used to assess the functional limitations of a patient with a disorder of one or both lower extremities as well as to evaluate the effectiveness of an intervention (Binkley, Stratford, Lott, and Riddle, 1999). The questionnaire is scored on a scale of 0–80 with each question rated from 0–4 with 0 = Extreme Difficulty or Unable to Perform Activity and 4 = No Difficulty. The lower the score, the greater the limitation; the MCID is 9 points (Binkley, Stratford, Lott, and Riddle, 1999).

Initial findings

On the initial examination, the patient's systems review was unremarkable. Subjectively, she reported experiencing nocturnal cramps in her right calf muscle and bilateral plantar aspects of her feet 3–4 times/night lasting for several minutes at a time. The patient exhibited decreased strength with ankle plantar flexion, eversion, and inversion secondary to increased onset of symptoms (Table 1). The patient presented with decreased PROM into toe extension and decreased toe flexor strength. The patient's worst pain of 6/10 on the NPRS was experienced only during episodes of cramping with 0/10 otherwise. The patient's LEFS was scored at 87.50% (70/80), with a lower score indicative of

Table 1. Manual muscle test scores at admission and at discharge.

	Pre-intervention MMT		Post-intervention MMT	
Movement	R LE	L LE	R LE	L LE
Ankle dorsiflexion	*−4/5*	*+4/5*	*5/5*	*5/5*
Ankle plantarflexion	*4/5 (16 reps)*	*4/5 (21 reps)*	*5/5 (25 reps)*	*5/5 (25 reps)*
Ankle eversion	*+3/5*	*4/5*	*5/5*	*5/5*
Ankle inversion	*+3/5*	*4/5*	*5/5*	*5/5*
Toe flexion	*−4/5*	*−4/5*	*5/5*	*5/5*

R = Right; L = Left; LE = Lower Extremity; reps = repetitions increased functional limitations. The Single-Leg Squat Test revealed: decreased balance and stability, increased medial knee displacement and knee valgus, contralateral pelvic drop, and increased onset of foot pain. The patient was able to complete four repetitions of the 30-second Sit-to-Stand Test. The test revealed knee valgus and decreased endurance; she was unable to continue secondary to an onset of cramping symptoms. Thus, the 30-second Sit-to-Stand Test became a provocation test for lower limb cramping instead of a test of dynamic balance control, functional mobility, and lower extremity strength.

The differential diagnoses for the patient in this case report included restless leg syndrome (RLS), periodic limb movements, peripheral vascular disease, peripheral neuropathy, and dystonia (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010). The patient was not suspected to have any of these diagnoses upon examination by her physician, did not present with any of the common symptoms present with these diagnoses, and demonstrated no consistency with common aggravating/easing factors present with these alternative conditions.

Interventions

The patient attended physical therapy in an outpatient clinical setting and completed seven sessions over seven weeks. A multifactorial approach was taken with her rehabilitation interventions. This included addressing joint mobility, tissue extensibility and flexibility, muscle strength and motor control, and biomechanical influences during functional movement activity (Table 2) (Bolgla and Malone, 2004; Mauntel et al., 2013; Soysa, Hiller, Refshauge, and Burns, 2012).

Stretching

Based on the study by Hallegraeff, van der Schans, de Ruiter, and de Greef (2012), six weeks of nightly stretching of the calf and hamstring muscles significantly reduced the frequency and severity of nocturnal leg cramps in older adults. The patient was educated in and provided with a home exercise program that focused on improving muscle flexibility of the hamstring and calf muscles as well as improving tissue extensibility of the plantar fascia and intrinsic muscles of the foot, areas where her cramping most frequently occurred (Daniell and Pentrack, 2013; Hallegraeff, de Greef, and van der Schans, 2013; Hallegraeff, van der Schans, de Ruiter, and De Greef, 2012). A 15-second stretch repeated four times was held for the hamstring, gastrocnemius, and soleus muscle groups; these parameters are in line with the recommendations of previous investigators (Daniell and Pentrack, 2013; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). The patient also was instructed in a plantar fascia stretch described by Digiovanni et al. (2006) (Figure 1). The therapist provided verbal instructions along with demonstrations of proper performance of all of the home exercises. The patient then practiced the exercises until she demonstrated proper technique in performing them. She was encouraged to follow the stretching program 2–3 times per day, prior to any weight-bearing activity, before standing out of bed in the morning, and before going to sleep at night (Digiovanni et al., 2006). Additionally, the patient was encouraged to massage her feet 2–3 times per day by gently rolling the plantar fascia with a frozen water bottle on the floor.

According to consistent feedback provided by the patient, she regularly performed her home exercise program with primarily stretching and icing her feet before getting out of bed in the morning, as needed during the day, and prior to going to bed at night. She additionally applied essential oils, per her preference, prior to massaging her feet.

Strengthening/motor control

Therapeutic exercises were performed in side lying, sitting, and standing in order to increase bilateral

Table 2. Specific interventions provided by category.

Stretching	Strengthening	Functional movement
Hamstring stretch Gastrocnemius stretch Soleus stretch Plantar fascia stretch Plantar fascia rolling with an iced water bottle	Straight-leg raises (flexion, abduction, extension) Bridging Heel raises (double and single leg stance) Hip hikes Standing hip flexion, extension, abduction, and adduction with resisted bands Toe towel crunches Toe flexion/extension Toe marble pick-up Ankle dorsiflexion, plantar flexion, eversion, and inversion with resisted bands	Squats (double and single leg stance) Forward step-ups Lateral step-ups Repeated sit-to-stand

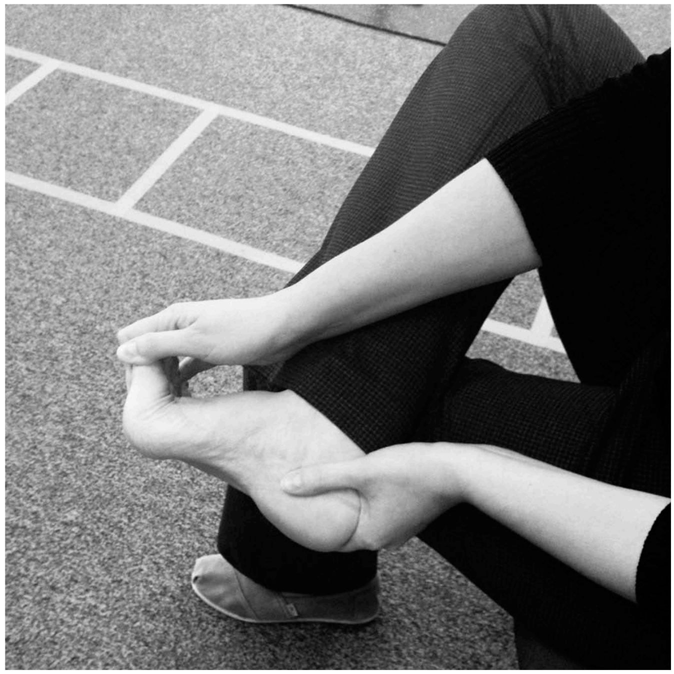

Figure 1. Demonstration of plantar fascia-stretching exercise. The patient is instructed to cross the affected lower limb over the contralateral lower limb. While placing the fingers across the base of the toes, the patient should pull the toes up toward the tibia until the patient feels a stretch in the arch or plantar fascia.

lower extremity muscle strength (Bolgla and Malone, 2004). The specific exercises were chosen based on the results of the manual muscle testing, SLS Test, and 30-second Sit-to-Stand Test as well as a review of the research literature. Emphasis was placed on decreasing hip adductor activity, increasing hip abductor and external rotator activity (Mauntel et al., 2013), and increasing intrinsic foot muscle strength (Soysa, Hiller, Refshauge, and Burns, 2012) to improve functional movement and eventual return to recreational walking and running. Additionally, the patient was educated in and provided with a home exercise program to augment the therapeutic intervention performed in the clinic. Initially, the patient was instructed to perform the exercises once a day for ten repetitions for each exercise. The intensity and frequency of the exercises increased thereafter as the frequency and intensity of the cramping episodes decreased.

Side-lying mat exercises included bridging and hip abduction, flexion, and extension. Hip abduction was specifically chosen to increase hip abductor activity for increased stability with sit-to-stand, single-leg squats, and running.

Standing exercises included: squats, single-leg squats, hip hikes, hip movements in the sagittal and frontal planes with resisted tubing; and double leg and single-leg heel raises. The squats and single-leg squats were chosen to improve strength and technique with sit-to-stand and with running. The resisted hip exercises and heel raises were performed to increase tolerance with activity and decrease frequency of muscle cramping.

Seated exercises included: toe towel crunches; toe extension and flexion; toe marble pick-up; and resisted ankle dorsiflexion, plantar flexion, eversion and inversion with resisted bands. These exercises were performed to increase intrinsic foot muscle strength to improve tolerance with the weight bearing activities of walking and running.

Functional movement

Based on the patient's goal of being able to run and walk without an onset of cramps and the outcomes of the activities and participation measures (i.e. LEFS, 30-second sit-to-stand, and the single-leg squat test), functional movement interventions focused on normalizing biomechanical influences during mobility activities (Bolgla and Malone, 2004). Task-specific exercises included squats, single leg squats, sit-to-stand, forward step-ups, and lateral step-ups. Squats and single-leg squats with visual, verbal, and tactile cueing to decrease medial knee displacement and increase hip abductor activity were chosen to improve the kinematics of sitting-to-stand. Forward and lateral step-ups were chosen to assimilate techniques acquired with squats into the functional movement of repeated stepping in multiple directions.

Lastly, the patient followed the recommendation of the physical therapist and altered her footwear from wearing sandals to wearing new running shoes or boots. Furthermore, she purchased a new pair of custom shoe orthotics to replace the ones she had been using for several years. She also wore compression foot arch sleeves when sleeping, based on her physician's recommendation.

Outcomes

The patient attended all seven scheduled therapy sessions and verbalized compliance with her home program. However, a formal means of monitoring compliance with the home program was not instituted. The patient reported no adverse events throughout the seven-week plan of care. At the time of discharge, the patient demonstrated improvements in multiple aspects including: cramp frequency, cramp duration, pain, strength, and functional mobility (Tables 1 and 3). She reported experiencing decreased frequency and severity of nocturnal lower limb cramps from 3–4 times/night and lasting several minutes down to one episode/week and lasting less than a minute. The patient reported decreased pain to 0/10 on the NPRS over the previous 5 weeks. With MMT, she demonstrated increased strength, notably ankle plantar flexion, having performed 25 repetitions with no pain or onset of cramping symptoms. The patient's LEFS was scored at 80.0% (64/80), which indicated greater disability relative to the initial examination score of 87.5% (70/80). At the time of discharge, the patient had not yet resumed her regular running routine but had been able to walk her dog regularly and walk for prolonged periods (e.g. 2–3 hours when on vacation) without symptom provocation. The SLS Test revealed increased balance and stability, decreased medial knee displacement and knee valgus, decreased contralateral pelvic drop, and decreased onset of foot pain and cramping. The patient was able to complete ten repetitions with the 30-second Sit-to-Stand Test, did not experience any pain or foot cramping symptoms, and was able to persevere throughout the entire 30 seconds.

Discussion

The purpose of this case report was to describe the effect of potential contributing factors and non-pharmacologic interventions in the treatment of a patient experiencing nocturnal lower limb cramps. Non-pharmacologic interventions for nocturnal lower limb cramps include muscle stretching, massage, relaxation, sensory nerve stimulation, footwear changes, weight loss, physical exercise, avoiding physical fatigue, heat therapy, compression garments, night ankle dorsiflexion splints, placebo, reassurance, and changes to sleeping-sitting positions (Blyton, Chuter, Walter, and Burns, 2012). Specifically, forceful stretching has been demonstrated to inhibit and relieve an acute cramp, is easy to perform, is of low risk, and provides pain relief (Allen and Kirby, 2012; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). Anecdotally, the evidence has suggested that mild exercise before bedtime could relieve nocturnal lower limb cramps and if muscle fatigue was a cause, graded exercise and/or physical therapy may prove beneficial (Allen and Kirby, 2012). Furthermore, it has a biopsychosocial impact as it provided patients with a behavioral strategy to influence their well-being, which in turn impacted their attitude toward recovery (Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012). For the patient in this case report, a structured exercise program focusing on stretching, strengthening, and functional movements appeared to have led to improvements in her impairments, namely

Table 3. Pre- and post-intervention outcomes.

Measures	Pre-intervention results	Post-intervention results
Cramp frequency	3–4 times/night	1 time/week for the past 5 weeks
Cramp duration	Several minutes	Less than a minute
Numerical Pain Ratings Scale (NPRS) MCID = 1 point (Salaffi et al., 2004)	0/10 (current) 0/10 (best) 6/10 (worst—during cramping episodes)	0/10 (current) 0/10 (best) 0/10 (worst)
Lower Extremity Functional Scale (LEFS) MCID = 9 points (Binkley, Stratford, Lott, and Riddle, 1999)	Raw Score: 70/80 87.50%	Raw Score: 64/80 80.00%
Single-Leg Squat Test	Decreased balance and stability; increased medial knee displacement and knee valgus; contralateral pelvic drop; increased onset of foot pain	Increased balance and stability; decreased medial knee displacement and knee valgus; decreased contralateral pelvic drop; no foot pain or cramping reported
30-second Sit-to-Stand Test	4 repetitions; knee valgus during movement; increased onset of foot cramping/pain	10 repetitions; no foot pain or cramping reported

cramping, but not in her quality of life. The lack of a structured biopsychosocial intervention may have contributed to the lack of improvement in perceived quality of life despite the improvement in her impairments.

The change in her NPRS scores was substantially greater than the MCID of 1 point for chronic musculoskeletal pain (Salaffi et al., 2004), indicative of a meaningful reduction of pain symptoms. Furthermore, manual muscle testing and functional mobility testing did not provoke pain symptoms.

The MCID of the LEFS is about ± 9 scale points. This indicates that clinicians can be reasonably confident that a change of greater than 9 scale points is not only a true change but also clinically meaningful (Binkley, Stratford, Lott, and Riddle, 1999). The standard error associated with the LEFS is about ± 5 scale points. This indicates that clinicians can be reasonably confident that an observed score is within 5 points of the patient's "true" score (Binkley, Stratford, Lott, and Riddle, 1999). The patient's LEFS at the initial examination was 87.50% (70/80) and 80.00% (64/80) at discharge, which indicated greater activities limitations and participation restrictions. Based on the MCID, however, the raw score change of 6 scale points, which was not equal to or greater than the MCID of 9 points, was not a clinically meaningful change (Binkley, Stratford, Lott, and Riddle, 1999). Additionally, the standard error of ±5 scale points produced an overlap of the initial and final score ranges (initial = 65–75/80; final = 59–69/80), indicating that the patient's "true" score had not significantly decreased (Binkley, Stratford, Lott, and Riddle, 1999). This decrease could also be related in part to the patient's perception of her current abilities. At the initial examination, she had not participated in her regular running routine over the previous 2 months and had only recently resumed her routine upon discharge. The only items scored lower on the LEFS upon discharge were related to running and performing usual sporting activity. Subsequently, as the patient had not been running over the past several months, she scored it as currently being more difficult to perform, which is consistent with general deconditioning.

Though the Single-Leg Squat Test and the 30-second Sit-to-Stand Test may be used to identify risk for lower extremity injuries, poor movement patterns, and assessment of lower extremity strength and endurance, the primary utility for this patient was that her symptoms were initially brought on with coming from sit-to-stand and with running. Thus the 30-second Sit-to-Stand Test became a provocation test for cramping for this patient. Not only did her strength, endurance, and biomechanics improve, but she did not experience any symptoms or have any restriction with these functional movements at the conclusion of therapy. For this patient, at least, the 30-second Sit-to-Stand Test was a valid method of documenting the resolution of her cramping symptoms.

The outcomes demonstrated that daily stretching of the hamstring, calf, and foot muscles significantly decreased the frequency and severity of the patient's cramps. At the onset, she reported experiencing nocturnal lower limb cramps three to four times every night over the previous two months with each episode lasting several minutes. Upon discharge, she reported one episode of cramping over the previous five weeks since beginning physical therapy, with the episode lasting less than a minute. These outcomes were consistent with the evidence and research suggesting that stretching and strengthening exercises were effective in preventing the occurrence of lower limb cramps (Allen and Kirby, 2012; Blyton, Chuter, Walter, and Burns, 2012; Daniell and Pentrack, 2013; Hallegraeff, de Greef, and van der Schans, 2013; Hallegraeff, van der Schans, de Ruiter, and de Greef, 2012; Monderer, Wu, and Thorpy, 2010).

For this patient, the efficacy of non-pharmacologic interventions, specifically targeting stretching, strengthening, and the initiation of functional movement, in the treatment of lower limb cramps seemed to be realized. Other contributing factors to her positive outcomes may have been her active lifestyle, self-proclaimed adherence to her home program, and lack of co-morbidities.

One limitation of this case report is that the patient pursued other interventions that were not deemed to be deleterious but also were not recommended by the physical therapist (e.g. application of essential oils to her feet, wearing compression foot arch sleeves). Future comparisons between the various interventions implemented with this patient are warranted. Future research into the efficacy of physical therapy for patients with nocturnal lower limb cramps should provide better control over the interventions provided. The influence of the age of the subject on the outcomes experienced also warrants investigation.

Conclusion

The findings of this case report suggest that for an individual with nocturnal lower limb cramps, non-pharmacologic interventions focusing on muscle strength, joint mobility, soft tissue extensibility, and biomechanical influences during functional movements appeared to be feasible, practical, and efficacious. Measureable improvements in body structure/function impairments, however, do not always lead to improvements in perceived quality of life.

Declaration of interest

The authors report no conflicts of interest.

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