Journal of Yoga & Physical Therapy
ISSN: 2157-7595

Zimmermann et al., J Yoga Phys Ther 2017, 7:4
DOI: 10.4172/2157-7595.1000277

Short Communication Open Access

Gait Retraining for Young Soldiers with Resistant Exercise Related Leg Pain: A Short Communication on Recent Findings

Wes O Zimmermann[1,3*], **Naomi van Valderen**[2] **and Anthony I Beutler**[3]

[1]*Department of Sports Medicine, Royal Dutch Army, Utrecht, The Netherlands*

[2]*Erasmus Universiteit, Rotterdam, The Netherlands*

[3]*Uniformed Services University of the Health Sciences, Bethesda, Maryland, USA*

[*]**Corresponding author:** Wes O Zimmermann, Department of Sports Medicine, Royal Dutch Army, Utrecht, The Netherlands, Tel: 31-651163409; E-mail: wesselzimmermann@hotmail.com

Received date: November 08, 2017; **Accepted date:** November 20, 2017; **Published date:** November 27, 2017

Abstract

Exercise related leg pain (ERLP) is a common problem in the military and has a large impact on basic military training. Gait retraining as a treatment for ERLP, with the goal of reducing symptoms and preventing recurrence of ERLP is presumably widespread practice, despite a paucity of clinical evidence of its effectiveness. The Royal Dutch Armed Forces have performed several recent gait retraining studies in experimental and clinical settings. Symptom reduction and reductions in ground reaction forces while running and marching in running shoes and in military boots can be achieved and maintained long-term after approximately five individual training sessions over a three-month period. Gait retraining as a method of treatment and prevention of ERLP in the military deserves more study to confirm our promising findings.

Keywords: Exercise related leg pain; Medial tibial stress syndrome; Chronic exertional compartment syndrome; Gait retraining; Military

Introduction

Exercise related leg pain (ERLP) is a common problem in the military and has a large impact on basic military training [1]. Specific diagnoses within the ERLP syndrome group are Medial Tibial Stress Syndrome (MTSS), Chronic Exertional Compartment Syndrome (CECS), tibial and fibular stress fractures, tendinopathy, nerve entrapment and vascular pathology [2].

In The Royal Dutch Armed Forces the three most common diagnoses in the ERLP group are: 1) Medial Tibial Stress Syndrome, 2) Chronic exertional compartment syndrome and 3) A combination of both MTSS and CECS symptoms [3]. In contrast to reports from the armed forces of other nations, stress fractures of the leg are extremely rare in The Netherlands [3].

Retrospective studies have produced a myriad of possible risk factors for ERLP in military settings [3]. Many of these risk factors are not readily modifiable, e.g. sex, or cannot be used as a criterion to refuse a person entrance into the armed forces, e.g. smoking or a history of previous lower limb overuse injuries. Two prospective studies in the military have shown that high risk individuals for ERLP can be identified by pressure plate assessment of barefoot walking gait [4,5]. The next logical step is prevention of ERLP by gait retraining of young soldiers and has also been performed successfully. Sharma reports a decrease in the incidence of MTSS in British Army recruits who received a combined program of gait retraining, exercises for neuromuscular control, flexibility and biofeedback on foot balance [6].

Gait retraining as a treatment for ERLP, with the goal of reducing symptoms and preventing recurrence of ERLP, is presumably widely practiced, despite a paucity of clinical evidence of its effectiveness [7]. The rationale for gait retraining in MTSS is a reduction of the vertical ground reaction forces working on the legs [8]. The rationale for gait retraining in CECS is reduction of musculus tibialis anterior activity [9].

Initial results of gait retraining for CECS are very promising [10]. Patients often report complete resolution of symptoms, and typically do not require surgery (fasciotomy). Gait retraining as a treatment for MTSS has not yet been formally studied, but is advocated by experts [7]. In the military setting running in running shoes, running in military boots and marching in military boots are common occupational activities and must all be addressed in ERLP rehabilitation [3].

Studies in the Royal Dutch Armed Forces

Historically the Royal Dutch Armed Forces have recognized CECS as a common occupational overuse injury of soldiers. In previous years general surgeons in the Central Military Hospital (CMH) have worked to advance the diagnosis and treatment of this condition [11-13]. However, from 2011 onward, the department of sports medicine has taken the lead in efforts to improve diagnostic procedures and treatment of ERLP.

In a controlled experimental setting, using 18 training sessions over six weeks, Helmhout et al. reproduced the findings by Diebal [14] on gait retraining of running technique as a treatment for CECS. Gait retraining led to symptom reduction and reduced intra compartmental pressures. In a second study involving retraining of marching technique in boots, symptom reduction was achieved again, this time by seemingly small changes in marching biomechanics, as measured on an instrumented treadmill [15].

In a clinical, outpatient setting, a retrospective analysis of 61 cases from the year 2015 showed that soldiers with resistant ERLP, including patients with MTSS, respond well to a treatment program that includes

gait retraining of running technique in running shoes. With as little as 2.4 individual gait retraining sessions on average, patient satisfaction ratings were quite positive: 84% attributed some, a majority, or all of their symptom reduction to gait retraining and 70% reported they mastered the new running technique within two months. Adverse effects were limited to temporary calve complaints. Ten months post gait retraining, running biomechanics on an instrumented treadmill were still significantly different from intake, in particular a persistent change from heel strike to mid foot strike and a substantial reduction of vertical ground reaction forces to the heels while running were still present in most cases [16].

	2015*	**2017****	**2017****
Gait retraining, soldiers with resistant ERLP	Running shoes	Running shoes	Military boots
Sex	Males only	Males only	Males only
Number of participants	48	10	10
Age	25 ± 5	23 ± 3	23 ± 3
Height (m)	1.82 ± 0.1	1.82 ± 0.1	1.82 ± 0.1
Weight (kg)	86.9 ± 11.0	83.8 ± 10.4	83.8 ± 10.4
Duration of complaints (months)	12.5 ± 12.3	8.6 ± 8.4	8.6 ± 8.4
SANE in	55 ± 19	52 ± 16	52 ± 16
Duration of treatment (days)	119 ± 63	105 ± 46	105 ± 46
SANE out	78 ± 19	79 ± 20	79 ± 20
Number of gait retraining sessions	2.4 ± 1.3	5.0 ± 0.9	5.0 ± 0.9
End effect: stride length (cm)	94%	88%	88%
End effect: cadence (steps/min)	107%	114%	112%
End effect: max force heel (N)	34%	40%	38%
End effect: max force mid foot (N)	106%	103%	140%
End effect: max force forefoot (N)	87%	89%	83%
End effect: max pressure heel (N/cm^2)	60%	54%	55%
End effect: max pressure mid foot (N/cm^2)	98%	89%	104%
End effect: max pressure forefoot (N/cm^2)	106%	111%	105%

Table 1: Biomechanical changes and subjective improvement (SANE) resulting from gait retraining of soldiers with resistant ERLP; 2015 in running shoes, 2017 in running shoes and military boots (same 10 patients). Note: gait retraining in boots reduces maximal force on the heel, but increases maximal force on the mid foot; End effect=compared to intake (=100%); ERLP=Exercise Related Leg Pain; SANE=Single Assessment Numerical Evaluation [17]; *Zimmerman et al. [16]; **study in progress, preliminary data.

In the same clinical, outpatient setting, again using an instrumented treadmill to measure running biomechanics, a prospective study is underway. This time the effects of gait retraining on the biomechanics of running in shoes and in military boots are measured. Preliminary results of 10 male resistant ERLP cases show the following: 1. Soldiers have very similar running biomechanics in running shoes and boots before intervention: stride length, cadence and maximal Force (N) on heel, mid foot and forefoot are not significantly different for the two shod conditions; 2. Gait retraining in running shoes achieves very similar results in 2015 [16] and 2017 (Table 1, columns 2 and 3); 3. The gait retraining instructions achieve similar changes in stride length (reduction), cadence (increase) and forces on the heel (significant reduction) in running shoes and in military boots. However, in boots the new running technique increases maximal forces in the mid foot significantly (Table 1, column 4).

Discussion

We conclude from our studies that soldiers with resistant ERLP, among them soldiers with MTSS, respond well to a treatment program that includes gait retraining. Our current outpatient conservative treatment program, with emphasis on gait retraining of running and marching in running shoes and boots, can substantially reduce symptoms in many patients and has reduced the need for fasciotomy for CECS [3].

In our studies gait retraining was mostly introduced with the patients barefoot on the treadmill and with four basic instructions that were repeated throughout the gait retraining program:

1. Change from heel strike to a ball-of-the foot landing (when applicable);

2. Increase cadence to 180 steps/min (at a constant training speed of 10 km/h this results in a reduction of stride length);

3. Stand up taller, don't bend over at the waist or look down;

4. Increase knee-lift by 1-2 cm.

Additional useful instructions were: 1. Run with less noise (for soldiers: "the enemy is in the area, do not make yourself heard"); 2. After landing on the ball-of-the-foot, do allow the heel to touch the ground.

Five individual gait retraining sessions over a three-month period were reported as "adequate" by the vast majority of patients. Patients find mastering the new running technique in military boots more difficult than in running shoes, therefore training sessions focusing on running in military boots are an important component of the gait retraining program, particularly for those soldiers with a military specialty where running and marching in boots is essential. Running in boots will never be as comfortable as running in running shoes, but it will remain a military occupational requirement. Finally, it is important to transfer the new running technique from the treadmill in the lab to an outdoor situation under supervision. Some patients unconsciously revert to old biomechanical patterns when running in an outdoor environment.

Future studies on gait retraining in the military should determine the effectiveness of this treatment. This requires a controlled prospective study, where some patients receive gait retraining and others do not. In addition, studies are needed on possible prevention strategies for ERLP in military recruits. It is clear that less running, less marching and more sleep are interventions that can reduce ERLP injuries in military settings [18,19]. It is unclear if gait retraining is feasible and cost effective as a primary prevention modality across large populations. A prospective study involving gait retraining and other interventions, preferably across militaries of several nations would be a most powerful study design.

References

1. Sharma J, Greeves JP, Byers M, Bennett AN, Spears IR (2015) Musculoskeletal injuries in British Army recruits: A prospective study of diagnosis-specific incidence and rehabilitation times. BMC Musculoskelet Disord 16: 106.
2. Reinking MF (2007) Exercise related leg pain: A review of the literature. N Am J Sports Phys Ther 3: 170-180.
3. Zimmermann WO, Helmhout PH, Beutler A (2017) Prevention and treatment of exercise related leg pain in young soldiers: A review of the literature and current practice in the Dutch armed forces. J R Army Med Corps 163: 4-103.
4. Sharma J, Golby J, Greeves J, Spears IR (2011) Biomechanical and lifestyle risk factors for medial tibia stress syndrome in army recruits: A prospective study. Gait Posture 33: 361-365.
5. Franlyn-Miller A, Bilzon J, Wilson C, McCrory P (2014) Can RSScan footscan(®) D3D™ software predict injury in a military population following plantar pressure assessment? A prospective cohort study. Foot 24: 6-10.
6. Sharma J, Weston M, Batterham AM, Spears AR (2014) Gait retraining and incidence of medial tibial stress syndrome in army recruits. Med Sci Sports Exerc 9: 1684-1692.
7. Barton CJ, Bonanno DR, Carr J, Neal BS, Mallarias P, et al. (2016) Running retraining to treat lower limb injuries: A mixed-methods study of current evidence synthesized with expert opinion. Br J Sports Med 50: 513-526.
8. Davis IS, Bowser BJ, Mullineaux DR (2016) Greater vertical impact loading in female runners with medically diagnosed injuries: A prospective investigation. Br J Sports Med 50: 887-892.
9. Landreneau LL, Watts K, Heitzman JE, Childers WL (2014) Lower limb muscle activity during forefoot and rear foot strike running techniques. Int J Sports Phys Ther 7: 888-897.
10. Diebal AR, Gregory R, Alitz C, Gerber JP (2012) Forefoot running improves pain and disability associated with CECS. Am J Sports Med 5: 1060-1067.
11. Reneman RS (1975) The anterior and the lateral compartmental syndrome of the leg due to intensive use of muscles. Clin Orthop Rel Res 113: 69-80.
12. Verleisdonk EJMM (2000) Chronic exertional compartment syndrome. PhD thesis. Utrecht, Dutch.
13. Brand van den JGH, Nelson T, Verleisdonk EJMM, Werken van der C (2005) The diagnostic value of intracompartmental pressure measurement, magnetic resonance imaging and near-infrared spectroscopy in chronic exertional compartment syndrome. Am J Sports Med 33: 699-704.
14. Helmhout PH, Diebal AR, van der Kaaden L, Harts CC, Beutler A, et al. (2015) The effectiveness of a 6 week intervention program aimed at modifying running style in patients with chronic exertional compartment syndrome. Orthop J Sports Med 3: 3.
15. Helmhout PJ, Diebal A, Poelsma L, Harts CC, Zimmermann WO (2016) Modifying marching technique in military service members with chronic exertional compartment syndrome: A case series. Int J Sports Phys Ther 7: 1106-1124.
16. Zimmermann WO, Linschoten CW, Beutler A (2017) Gait retraining as part of the treatment program for soldiers with exercise related leg pain: Preliminary clinical experiences and retention. S Afr J Sports Med 29: 1.
17. Williams GN, Gangel TJ, Arciero RA, Uhorchak JM, Taylor DC (1999) Comparison of the single assessment evaluation method and two shoulder rating scales. Am J Sports Med 2: 214-221.
18. Knapik JJ, Bullock SH, Canada S, Toney E, Wells JD, et al. (2004) Influence of an injury reduction program on injury and fitness outcomes among soldiers. Inj Prev 10: 37-42.
19. Finestone A, Milgrom C (2008) How stress fracture incidence was lowered in the Israeli Army: A 25 year struggle. Med Sci Sports Exerc 40: S623-629.