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Are non-operative treatments as effective as fasciotomy at reducing symptoms in an active population with lower leg chronic exertional compartment syndrome

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Abstract

Purpose: The purpose of this literature review is to investigate whether non-operative treatments are as effective as fasciotomy at reducing symptoms in an active population with lower leg chronic exertional compartment syndrome (CECS).

Background: Chronic exertional compartment syndrome of the lower leg is a condition where with the onset of exercise the individual experiences an uncomfortable burning, tightness, numbness, and/or weakness in a specific compartment of the lower leg. The symptoms subside following cessation of activity. Fasciotomy is currently the gold standard treatment, but with success rates varying from 30% to 81% and symptom recurrence ranging from 8% to 44.7%, conservative treatments may provide a reasonable alternative to the current gold standard.

Case Description: The patient is a 24-year-old female runner who had bilateral lower leg four compartment fasciotomies completed when she was 16 years old. She presented to an orthopedic outpatient clinic with reports of recurrence of her symptoms. The patient did not want to have a revision fasciotomy unless it was the best treatment option and inquired about alternative treatment methods for helping to reduce the symptoms she was experiencing as a result of CECS.

Methods: Several databases were searched for current research regarding operative and non-operative treatment outcomes in active patients with CECS of the lower leg. Eight articles in total were selected and analyzed to investigate the answer to the proposed PICO question.

Discussion: There is little high quality evidence to support the effectiveness of either operative or non-operative treatment for the management of symptoms of CECS in the lower leg in an active population. Although current evidence does not lead to a conclusion about which treatment method is more effective, conservative treatments provide a safe, viable alternative for those who desire to avoid surgery.

Introduction

Chronic exertional compartment syndrome (CECS) occurs at a rate of 27% to 33% within the general population making it the second most common cause, following tibial stress syndrome, of activity-induced leg pain (Davis, Raikin, Garras, Vitanzo, Labrador, Espandar, 2013). Chronic exertional compartment syndrome is a condition where with the onset of exercise the individual experiences an uncomfortable burning, tightness, numbness, and/or weakness in a specific compartment of the body. The symptoms typically subside immediately following cessation of activity. However, if CECS is left untreated, the symptoms of CECS may take longer to resolve following exercise cessation (Davis et al., 2013). While its etiology is not completely understood, it is hypothesized that with CECS the person is experiencing a "temporary neurogenic claudication" in which the nerves are not receiving sufficient blood due to the increased compartment pressure which produces symptoms (Braver, 2016). Furthermore, the abnormal increased compartmental pressure is thought to stimulate mechanoreceptors and nociceptors (Davis et al.,2013). The increased compartment pressure could be the result of increased volume of the contents within the fascial compartment, decreased size of the fascial covering or a lack of extensibility of the fascial tissue itself (Braver, 2016).

While CECS has the potential to affect the thigh, foot, and forearm, 95% of cases occur in the lower leg and 82% of cases present bilaterally (Rajasekaran & Finnoff, 2016). Within the lower leg, the most commonly affected compartments are the anterior and lateral compartments (Schubert, 2011). In addition to patient report of symptoms that follow a compartmental sensorimotor distribution during exertional activity, a diagnosis of CECS is confirmed by having the patient undergo dynamic intracompartmental pressure measurement using a Stryker Intra-Compartmental Monitor System. A study completed by Staudt, Smeulders, and van der Horst

(2008) examined normal compartmental pressures of the lower leg in healthy adults and children. Average resting compartment pressures of the lower leg for adults were 9.5mmHg for the anterior compartment, 6.0 for the lateral compartment, 5.15mmHg for the deep posterior compartment, and 5.7mmHg for the superficial posterior compartment (Staudt, Smeulders, & van der Horst, 2008). Normal resting compartment pressures of the lower leg in children between the ages of two to seven years old were found to be 16.6mmHg in the anterior compartment, 14.3mmHg in the lateral compartment, 13.4mmHg in the deep posterior compartment, and 14.1mmHg in the superficial posterior compartment (Staudt, Smeulders, van der Horst, 2008). Thus, an adult patient must present with one or more of the following measurements in the symptomatic compartment to receive a diagnosis of CECS: ≥15mmHg resting pressure, ≥30mmHg 1 minute following activity, or ≥20mmHg 5 minutes following activity (Pedowitz, Hargens, & Mubarak, 1990). Diagnostic compartment pressures for CECS in children has not been established due to the diagnosis primarily presenting in early adulthood. Aside from intracompartmental pressure testing, functional MRI has been studied for CECS diagnostic purposes, but has not been proven to be a useful diagnostic tool for CECS (McDonald & Bearcroft, 2010).

According to Rajasekaran and Finnoff (2016), the mean age of an individual who receives a diagnosis of CECS is 26 to 28 years old with symptoms lasting an average of 22 months. Incidence is equal amongst males and females with higher rates being documented in runners, soccer players, and military personnel (Rajasekaran & Finnoff, 2016). Established risk factors for developing CECS are use of anabolic steroids or creatine supplementation, as well as the use of these two supplements together simultaneously (Drexler, Rutenberg, Rozen, Warschawski, Rath, Chechik, Rachevsky, & Morag, 2017). These supplements in combination

with exercise are thought to increase both muscle volume and cause an influx of fluids resulting in increased compartmental volume (Drexler et al., 2017). Repetitive eccentric exercise of the plantar flexor and dorsiflexor musculature are also associated with the development of CECS, but require further study before being verified as a risk factor (Drexler et al., 2017).

While rest from activity that produces the symptoms and physical therapy are recommended to treat CECS initially, fasciotomy is the current gold standard for treatment in an active population (Schubert, 2011). Fasciotomy remains the gold standard of treatment for CECS due to it being the only evidence validated method for symptom reduction and due to the lack of research validating the efficacy of other treatment options (Rajasekaran & Hall, 2016). Despite physical therapy being recognized as the first line of treatment for CECS before fasciotomy, there are currently no direct studies available regarding its efficacy in treatment of CECS (Rajasekaran & Finoff, 2016). Of those who have a fasciotomy, recurrence of symptoms can range from 8% to 44.7% (Waterman, Laughlin, Kilcoyne, Cameron, & Owens, 2013; Drexler et al., 2017). Furthermore, success rates following fasciotomy, as defind by complete symptom resolution, range from 30% to 81% (Packer, Day, Nguyen, Hobart, Hannafin, & Metzl, 2013; Winkes, Hoogeveen, & Scheltinga, 2014). Complications have been reported to occur in up to 16% of individuals who undergo surgery (Rajasekaran & Finnoff, 2016). Documented complications of fasciotomy include infection, hematomas, neurovascular injury resulting in weakness, deep vein thrombosis, sensory deficits, lymphocele formation, and complex regional pain syndrome (Rajasekaran & Rinoff, 2016; Packer et al., 2013).

Given the high variability of success rates, the potential for recurrence of symptoms, and the extensive cost and risks associated with fasciotomy, non-operative methods for treating CECS may provide a reasonable alternative to the current gold standard of treatment. Available

non-operative methods for treating CECS include physical therapy, altering running form, soft tissue manual therapy, chemo denervation utilizing botulinum toxin, and ultra-sound guided (USG) fascial fenestration. The aim of this study is to explore the current available research regarding non-operative treatments to investigate if non-operative treatments are as effective as fasciotomy at reducing symptoms in an active population with CECS in the lower leg.

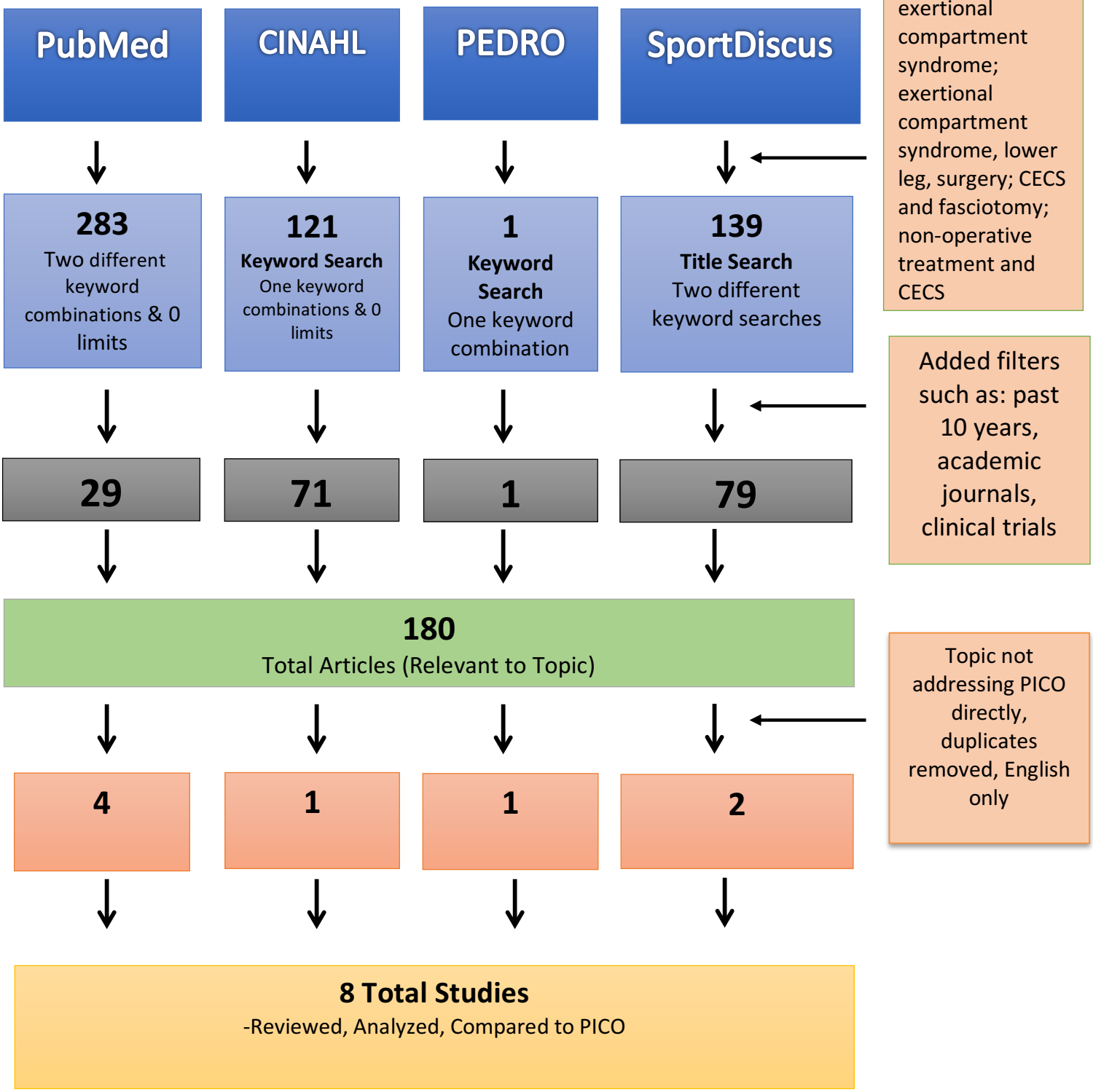
Case Description

The patient leading to the question of this literature review is a 24-year-old female runner who consistently runs 20 miles a week on both indoor and outdoor terrain. She had bilateral lower leg four compartment fasciotomies completed when she was 16 years old. She presented to an orthopedic outpatient physical therapy clinic with reports of first recurrence of her CECS symptoms in bilateral lower legs. Symptoms were present after 2 miles of running and would increase in intensity as she continued to finish her 4 mile daily runs. Symptoms would subside with rest and ice. The patient reported that the symptoms were slightly worse than prior to having the fasciotomy. The patient does not want to have a revision fasciotomy unless it is the best option available and inquired about alternative treatment methods for helping to reduce the symptoms she was experiencing as a result of CECS.

Methods

In conducting the literature review the following databases were utilized: PEDRO, CINAHL, PubMed, and SPORTDiscus. Search terms for the literature review included: chronic exertional compartment syndrome, lower leg, surgery, fasciotomy, non-operative treatment, conservative treatment, and exercise. Following a review of the titles and abstracts, a total of 8 articles were selected to address the research question. These 8 articles were reviewed, analyzed, and compared to the research question. A breakdown of the search is illustrated in Figure 1: Articles Included and Excluded for Analysis. Article summaries are located in Table 1: Article Summaries as well as in Appendix A. Article analysis are located in Appendix B.

Figure 1: Articles Included and Excluded for Analysis



	Study and Origin	Oxford Level of Evidence	Pedro Score	Purpose of Study	Outcome Measures	Results	Accept Results to Answer PICO Question
1	(Waterman et al., 2013) USA	4	N/A	Investigate outcomes following elective fasciotomy in an active patient population with CECS	Symptom reoccurrence, operative complications, revision surgery, return to full activity	44.7% reoccurrence of symptoms, 27.7% unable to return to full activity, 15.7% surgical complications, revision surgery 5.9%	Yes
2	(Diebal et al., 2012) USA	4	N/A	Effectiveness of a 6-week forefoot strike running intervention on reducing pain, disability, and anterior compartment pressure in an active population with CECS	VAS, LLOS, SANE, anterior compartment pressure	mean anterior compartment pressures significantly decreased (p=.001), VAS significantly decreased (p<.001), LLOS and SANE scores at both 6-week and one year follow up increased significantly (p<.001)	Yes
3	(Drexler et al., 2017) Israel	4	N/A	Investigate long term outcomes and complications of a single minimal incision fasciotomy in athletic individuals with CECS	NAS pain scale, Tegner score, SF-12, satisfaction rates, symptom recurrence, complication rates, activity level following surgery	Satisfaction (75.5%), symptom recurrence (14.8%), wound infection (3.7%), nerve damage (7.4%), NAS & SF-12 scores improved signifantly (p<.05), mean improvement Tegner score 14.6 points	Yes

4	(Collins & Gilden, 2016) USA	4	N/A	Investigate the effects of a functional manual therapy intervention on management of CECS in a 34-year-old competitive triathlete	NPRS, LEFS, compartment pressures at rest in left LE, GRC	2/10 NPRS score at following treatment with no cessation of activity, LEFS score 62 at baseline to 80 post intervention, Normal compartment pressures at rest in the left lower extremity post-intervention 11mmHg (deep posterior), 8mmHg (superficial posterior), 19mmHg (anterior), GRC of 6 and pain-free 3 years post intervention	Yes
5	(Winkes, Hoogeveen, & Scheltinga, 2014) Netherlands	3a	N/A	Examine the existing literature regarding outcomes following fasciotomy for deep posterior compartment syndrome of the leg	Odds ratio, success rates, symptom recurrence rates, complication rates	Intracompartmental pressure (ICP) immediately following exercise (OR 1.06, 95% CI) and a decrease in ICP 5 minutes following exercise (OR 1.11, CI 95%) were associated with success following surgery, Success rates 30% to 65%, Symptom recurrence rates 33.33% to 40%, no complications reported, no difference in success rates between men and women (p=0.59)	Yes

6	(Helmhout et al., 2015)	4	N/A	Investigate the effect of a 6-week center and home based intervention program emphasizing forefoot running technique in Dutch military personnel with CECS in the lower leg	Running distance, post run ICP, SANE, LLOS, PSC, GROC	Post-intervention running distance mean increase of 43%, post-run ICP mean decrease of 36%, SANE scores improved by 36% (p<05, CI 95%), LLOS improved by 18% (p<.05, CI 95%), PSC improved by 60% (p<.05, CI 95%), Mean GROC post intervention was 4+ to 5+ 4 months post intervention, SANE scores improved by 48% (p<.05, CI 95%), LLOS improved by 26% (p<.05, CI 95%), PSC improved by 81% (p<.05, CI 95%), GROC scores improved to 6+	Yes
7	(Packer et al., 2013) USA	4	N/A	Compare functional outcomes and patient satisfaction between non-operative and operative patients with CECS of the lower leg	Success rates, patient satisfaction, ICP, functional outcomes	Surgery group higher success rate (81%) relative to non-operative group (41%) (p<.001), operative group higher rates of patient satisfaction (81%) relative to non-operative group (56%) (p=.011), No significant correlation between ICP and	Yes

						patient outcomes (p>.05)	
8	(Rajasekaran & Hall, 2016) USA	3a	N/A	To systematically review existing literature on non-operative treatment options for CECS of the lower leg	Symptom reduction, Risks of intervention	All four treatment options had few or no reported adverse effects and can be considered in clinical practice, gait changes effective for symptom reduction of CECS at 1 year & USG fascial fenestration was effective for symptoms reduction at 1.5 years, massage effective if willing to temporarily cease activity, chemodenervation study lacked long term follow up Nonoperative treatment algorithm developed (Figure 2)	Yes

Table 1: Article Summaries

Discussion

While non-operative methods are often recommended as treatment options for CECS before opting to undergo a fasciotomy, research regarding their efficacy for symptom reduction relative to fasciotomy has not been previously explored. Given the high variability of symptom recurrence and functional limitations following fasciotomy, along with the potential for surgical complications, non-operative treatment methods present an alternative cost-effective and low risk treatment option for symptom reduction in active individuals with CECS of the lower leg. This literature review seeks to present information regarding symptom reduction in active individuals with CECS following fasciotomy and non-operative treatments to provide both the patient and healthcare providers with evidence to assist in deciding which treatment will provide optimal outcomes.

Outcomes following fasciotomy are difficult to generalize as there is no standardized method for performing a fasciotomy for CECS of the lower leg. There is variation in incision size, number of incisions made, and compartments released in each fasciotomy procedure. Thus, outcomes of fasciotomy could vary depending on the surgical technique selected. One study noted high patient satisfaction, as defined by ability to return to activity pain-free, and low symptom recurrence rates when using a single minimal incision fasciotomy technique in the lower leg (Drexler et al., 2017). However, this technique was only utilized at one hospital by one surgeon and thus, needs to be investigated for its clinical utility at other facilities. Likewise, Packer and colleagues noted patients who underwent surgery had a higher success rate regarding symptom resolution (81%) relative to the non-operative group (41%) ($p<.001$). Interestingly, this study noted varying satisfaction rates based on when the operation was completed with post-college patients having lower rates of success relative to high school and college aged patients.

This indicates the potential for healing following fasciotomy to be associated with age of the patient.

On the other hand, Waterman and colleagues (2013) noted high symptom recurrence rates of 44.7% and only 27.7% of the sample was unable to return to full activity following a fasciotomy. However, this study was completed utilizing a large male military sample indicating that the return to activity could be more rigorous than the general population with CECS and could thus influence the high symptom recurrence rates and low rates of return to activity. Winkes et al. (2014) presented higher quality evidence regarding efficacy of fasciotomy for CECS in the form of systematic review that included 7 studies analyzing 131 patients at varying surgical facilities. Their results revealed success rates, as defined by symptom resolution, following surgery ranged from 30% to 65% and that there was no difference in success rates between men and women ($p=0.59$) (Winkes et al., 2014). Despite this study being a systematic review, the results are undermined due to all studies receiving an Oxford level rating of 3, indicating lack of control groups and poor control in design. Amongst all the surgical studies, reported complications following surgery varied greatly and ranged from being as insignificant as poor scar healing to as serious as a deep vein thrombosis and neurological weakness.

The current non-operative treatment methods for CECS of the lower leg in the evidence are limited and suited best for a running population. Only seven studies addressing conservative treatment for CECS in the lower leg currently exist and each study is low quality evidence due to small sample sizes and lack of a control group. Two studies investigating a physical therapist designed and monitored forefoot running intervention reduced patient reported CECS symptoms long term while allowing the patient to continue running (Diebal et al, 2012; Helmhout et al., 2015). The external validity of these forefoot running studies is limited by the fact that both

studies were completed utilizing primarily male military personnel, indicating that results may not be applicable to the general running population or female patients. In a study by Collins and Gilden (2016), soft tissue manual therapy was a useful for decreasing CECS symptoms long term and allowing the patient to return to competing in triathlons, but the treatment was delivered in combination with rest from activity which serves as a large confounding variable given the etiology of CECS. Furthermore, the study was a case report completed with a female patient, which significantly limits the power of the results.

Ultra-sound guided (USG) fascial fenestration and chemo denervation utilizing botulinum toxin both produced symptom reduction in active young adult runners with CECS in the short term, but no data regarding their long-term symptom reduction is available (Rajasekaran & Hall, 2016). This indicates that these methods may have to be performed multiple times for symptom management or that they may only provide short term symptom relief for the patient. However, no adverse side effects were noted amongst participants who received any of the conservative methods, which indicates their potential to be clinically viable.

The current research available on the effectiveness of surgery and conservative treatment for treating symptoms of CECS of the lower leg is limited and of poor quality. No standardized measures for assessing outcomes following either treatment method exist making it difficult to determine "success" of the treatment aside from subjective reports. Without standardized outcome measures, statistical evidence is lacking and it is challenging to assess whether these outcomes are clinically meaningful. Furthermore, sample sizes in each study were small and most studies were conducted utilizing young male military personnel. Thus, the power and generalizability of the studies conducted on CECS in the lower leg are limited.

Selection bias was a large flaw noted in both surgical and non-operative studies for treatment of CECS of the lower leg. Studies regarding surgical outcomes were all retrospective and completed by the surgeons performing the fasciotomies. Given this vested interest in outcomes, this introduces the inherit bias to select patients with outcomes reflective of surgical success. Similarly, studies regarding non-operative measures were primarily case reports or case-series indicating that the researchers had the potential to selectively choose participants who would respond effectively to the utilized intervention. Without a control group in either instance, it is difficult to ascertain the extent to which the results were direct effects of the delivered treatment.

More studies regarding outcomes following conservative treatment and surgical treatment for CECS of the lower leg need to be performed. Because physical therapy is recommended for initial treatment for CECS of the lower leg, multiple studies looking directly at the efficacy of physical therapy for initial and long term symptom reduction are needed to address this gap in the evidence. These studies would benefit from selecting larger samples with equal female to male ratios to best represent the general population with CECS of the lower leg. Furthermore, introducing a wait-list control group in future studies would help eliminate an array of confounding variables that bring into question the results of the current studies.

Conclusion

While research regarding outcomes for symptom management of CECS of the lower leg following surgery or conservative methods is of poor quality and limited, the conclusion is that non-operative treatment methods provide a low-risk and cost effective means for helping the patient manage her symptoms. No adverse effects were noted from the non-operative treatment methods and the potential benefit of symptom reduction while avoiding potential complications

of surgery makes this option desirable for the patient. Furthermore, all noted conservative treatments are feasible due to their completion within a time frame that is clinically relevant.

It is important to note in patients who do not respond well to conservative treatments for CECS of the lower leg, fasciotomy remains a viable treatment option. At this point, a risk to benefit ratio must be discussed by both patient and surgeon to determine whether this option is suitable for the patient. While symptom recurrence and surgery success is variable following fasciotomy, in cases where the patient's symptoms are worsening or where the patient is unwilling to cease their activity of choice, this treatment method may provide effective functional outcomes for the patient.

Taking into consideration the evidence, clinical judgment, and the patient's desires, implementing a physical therapist designed plan of care that incorporates soft tissue manual therapy and educates the patient on how to utilize a forefoot running style may be the most feasible option for reducing the patient's CECS related symptoms. Based on the evidence, this indicates that the therapist needs to monitor the patient's cadence (180 steps/min) and teach the patient proper trunk biomechanics to effectively promote a forefoot running pattern. Because the patient desires to continue running and wants to avoid surgery, this option seems the most sport specific, cost effective, and low risk.

In conclusion, there is little high quality evidence to support the effectiveness of either operative or non-operative treatment for the management of symptoms of CECS in the lower leg. Thus, the answer to the presented PICO question is that the effectiveness of non-operative treatment methods for reducing symptoms of CECS relative to fasciotomy varies based on the non-operative treatment selected and characteristics of the patient. Despite the lack of research, conservative methods are being utilized to treat patients with CECS of the lower leg in a safe and

activity-specific manner in the case of active populations. While fasciotomy is the gold standard, surgical complications may occur and can have serious consequences for the patient. Although available evidence does not lead to a conclusion about which treatment method is more effective, conservative treatments provide a viable alternative to fasciotomy. Of the conservative treatment methods available for treatment of CECS, physical therapy is the only one that offers a patient centered and activity specific approach. With few risks and the potential for complete symptom resolution, physical therapy is a treatment option that may prove to be the long-term solution to symptom recurrence in active individuals with CECS.

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Appendix A: Article Summaries

Waterman, B.R., Laughlin, M., Kilcoyne, K., Cameron, K.L., & Owens, B.D. (2013). Surgical treatment of chronic exertional compartment syndrome of the leg: Failure rates and postoperative disability in an active patient population. *The Journal of Bone and Joint Surgery. American Volume, 95*(7), 592-6. doi:10.2106/JBJS.L.00481

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To investigate rates of symptom reoccurrence, return to activity, and revision surgery following a fasciotomy in the lower leg in an active patient population with CECS.

Methods: 611 patients who received an anterior, lateral, and/or posterior compartment fasciotomy for chronic exertional compartment syndrome between the years of 2003 and 2010 were selected from the Military Health System Management Analysis and Reporting Tool. Data regarding sex, age, rank, rates of post-operative complications, revision rates, activity limitations and symptom reoccurrence rates were obtained from the medical records and further analyzed.

Results: Of the sample population, 44.7% reported a reoccurrence of symptoms following surgery, 27.7% of the sample reported being unable to return to full activity following surgery, and 15.7% of the sample experienced surgical complications. Revision surgery was performed in 5.9% of the population. Failure of fasciotomy was associated with bilateral limb involvement (OR, 1.64), operative complications (OR, 2.12), activity limitations (OR, 4.41), and the continuation pre-operative symptoms (OR, 8.46).

Conclusion: The researchers conclude that the rates of symptom reoccurrence, activity limitation, and surgical complications following fasciotomy for CECS in an active population are high. Furthermore, they state more research needs to be done regarding fasciotomy outcomes in active patient populations with CECS to determine if it is an effective treatment. This study demonstrates the importance of exploring the alternative treatments aside from surgery for CECS in an active population to avoid symptom reoccurrence and complications that may arise as a result of having surgery.

Diebal, A.R., Gregory, R., Alitz, C., & Gerber, J.P. (2012). Forefoot running improves pain and disability associated with chronic exertional compartment syndrome. *The American Journal of Sports Medicine, 40*(5), 1060-7. doi:10.1177/0363546512439182

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To investigate the effect of a forefoot running pattern intervention on decreasing symptoms and disability in runners with CECS.

Methods: Ten hind foot striking patients with CECS were enrolled in this prospective study. At baseline, data regarding anterior compartment pressures, running distance, and kinematic (step length, step rate, support time) and kinetic (vertical ground reaction force, impulse, weight acceptance rate) variables, and VAS pain scores were collected. The Lower Leg Outcome Survey (LLOS) and Single Assessment Numeric Evaluation (SANE) were administered at baseline. Participants the completed a 6-week forefoot running pattern intervention. All baseline measures were then collected following the 6-week intervention and compared to baseline. The LLOS and SANE were also administered one year following the intervention.

Results: Following the intervention, mean anterior compartment pressures post run decreased from 78.4 ± 32 mmHg at baseline to 38.4±11.5 mmHg ($p=.001$). Running distance increased from 1.4± 0.6km to 4.8±0.5km ($p<.001$). Pain on the VAS decreased from 71.3± 7.9mm to 2.7± 5.1mm ($p<.001$). Step length and contact time decreased significantly ($p<.05$) and step rate increased significantly ($p<.05$) following the intervention. Vertical GRF, impulse, and weight acceptance rate all significantly decreased following the intervention ($p<.05$). Both SANE and LLOS scores were significantly greater ($p<.001$) at both the 6 week and one year follow up. No participant required surgery following the intervention.

Conclusion: Implementing a 6-week forefoot running intervention may be an effective treatment option for CECS in an active running population.

Drexler, M., Rutenberg, T. F., Rozen, N., Warschawski, Y., Rath, E., Chechik, G., Rachevsky, G., & Morag, G. (2017). Single minimal incision fasciotomy for the treatment of chronic exertional compartment syndrome: Outcomes and complications. *Archives of Orthopaedic and Trauma Surgery : Including Arthroscopy and Sports Medicine,137*(1), 73-79. doi:10.1007/s00402-016-2569-7

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To investigate the outcomes and complications following a single minimal fasciotomy in athletes with CECS.

Methods: 54 patients (95 legs) who had a single-incision minimal subcutaneous fasciotomy for CECS performed at the Tel Aviv Sourasky Medical Center in Israel between 2007 and 2011 were included in this retrospective case-series study. Each patient was asked to complete the numeric analog scale (NAS) and the Short Form-12 (SF-12) where they estimated their own pre-operative values. Tegner activity scores and quality of life (QOL) scores were obtained via the SF-12. A telephone interview was completed to obtain data regarding complications, recurrence of symptoms, current activity level, and level of satisfaction with the surgery.

Results: Satisfaction rates following surgery were 75.5% with major complications including wound infection (2.1% of patients) and nerve damage (4.2% of patients). Of the 54 patients who underwent surgery, 8 patients (8.4%) experienced recurrence of symptoms. Average pre-operative Tegner score was 79 with the average post-operative Tegner score being 93.6. Thus, the average change in Tegner score was 14.6 points. SF-12 and NAS scores significantly improved following the surgery ($p<.05$). There was no correlation between the level of satisfaction following the surgery and the level of activity reported by the patient ($P=0.332$).

Conclusion: Single minimal incision fasciotomy had high success rates and relatively few post-operative complications in this athletic population. This operation provides a reasonable treatment option for athletic individuals with CECS.

Collins, C.K., & Gilden, B. (2016). A non-operative approach to the management of chronic exertional compartment syndrome in a triathlete: A case report. *International Journal of Sports Physical Therapy, 11*(7), 1160-1176.

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To investigate the effect of a comprehensive physical therapy intervention using a Functional Manual Therapy (FMT) approach in a competitive triathlete with bilateral CECS.

Methods: This case report describes a 34-year-old female triathlete with bilateral CECS symptoms in the anterior and posterior lower leg who received 23 physical therapy treatment sessions over 3.5 months. The therapy sessions were based on an FMT approach which included addressing myofascial restrictions, enhancing neuromuscular function, and decreasing motor control impairments. At baseline, the following data was collected: numerical pain rating scale (NPRS) score, Lower Extremity Functional Scale (LEFS) score, and compartment pressures in the left lower extremity at rest. These measures were reassessed following the intervention. The Global Rating of Change (GRC) was assessed 3 years following the intervention.

Results: Following the intervention, the patient reported 2/10 pain on the NPRS that did not cause cessation of running as compared to the 7/10 pain with two miles of running she felt prior to treatment. The patient trained and ran in an Olympic distance triathlon 6 months post-intervention. LEFS score increased from 62 at baseline to 80 following the intervention. Compartment pressures at rest in the left lower extremity improved from 36 mmHG (deep posterior), 36-38mmHg (superficial posterior), and 25 mmHg (anterior) to 11mmHg (deep posterior), 8mmHg (superficial posterior), 19mmHg (anterior) following the intervention. Three years following the intervention, the patient reported a GRC of 6 and stated she was pain-free.

Conclusion: This study provides an example of how a conservative FMT intervention can successfully manage CECS symptoms and allow a triathlete return to their sport without pain.

Winkes, M.B., Hoogeveen, A.R., & Scheltinga, M.R. (2014). Is surgery effective for deep posterior compartment syndrome of the leg? a systematic review. *British Journal of Sports Medicine, 48*(22), 1592-1598. doi:10.1136/bjsports-2013-092518

Level of Evidence: Oxford 3a, PEDRO N/A

Purpose: To examine the existing literature regarding outcomes following fasciotomy for deep posterior compartment syndrome of the leg.

Methods: PubMed, EMBASE, MEDLINE, and CINAHL were searched for relevant articles from the earliest date to 2012. Articles had to meet the following inclusion criteria: surgery for lower leg posterior CECS, data on elevated compartmental pressures, clearly stated post-operative outcome, more than 5 patients, and be a complete paper. 7 articles level 3 evidence articles including 131 patients were systematically reviewed.

Results: Success rates following surgery ranged from 30% to 65%. Complications were not reported in any of the included studies. There was no difference in success rates between men and women (p=0.59). Two of seven studies reported recurrence of symptoms, with recurrence rates ranging from 33.33% to 40%. Intracompartmental pressure (ICP) immediately following exercise (OR 1.06, 95% CI) and a decrease in ICP 5 minutes following exercise (OR 1.11, CI 95%) were associated with success following surgery. Two of seven studies reported all patients returned to running pain-free. The surgery technique utilized was highly variable and ranged from superficial crural fasciotomy to fasciotomies of various deep posterior compartments.

Conclusion: Success rates are modest following fasciotomy in individuals with CECS in the deep posterior compartment of the leg. There is a lack of high quality evidence regarding surgical outcomes following fasciotomy and surgery technique is not standardized, which may lead to the variable outcomes.

Helmhout, P.H., Diebal, A.R., van der Kaaden, L., Harts, C.C., Beutler, A., & Zimmermann, W.O. (2015). The effectiveness of a 6-week intervention program aimed at modifying running style in patients with chronic exertional compartment syndrome: Results from a series of case studies. *Orthopaedic Journal of Sports Medicine, 3*(3). doi:10.1177/2325967115575691

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To investigate the effect of a 6-week center and home based intervention program emphasizing forefoot running technique in Dutch military personnel with CECS in the lower leg.

Methods: Nineteen members of the Royal Netherlands Army completed a 6-week intervention aimed at implementing a forefoot running pattern at both a center and at home. Running distance, post run intracompartmental pressure (ICP), Single Assessment Numeric Evaluation (SANE) scores, Lower Leg Outcome Survey (LLOS), and Patient Specific Complaints (PCS) were collected at baseline and compared to post-intervention results. Global Rating of Change (GROC) was collected post intervention. 14 patients completed the self-report surveys again at 4 months post-intervention.

Results: Post-intervention running distance had a mean increase of 43% and post-run ICP had a mean decrease of 36%. From pre-intervention to post intervention, SANE scores improved by 36% ($p<05$, CI 95%), LLOS improved by 18% ($p<.05$, CI 95%), and PSC improved by 60% ($p<.05$, CI 95%). Mean GROC post intervention was 4+ to 5+ (“somewhat better” to “moderately better”). At four months following the intervention, the SANE scores improved by 48% ($p<.05$, CI 95%), LLOS improved by 26% ($p<.05$, CI 95%), and PSC improved by 81% ($p<.05$, CI 95%). GROC scores improved to 6+ (“a great deal better”) at 4 month follow up.

Conclusion: In 19 military personnel with CECS in the lower leg, a 6-week center and home based intervention designed to promote a forefoot running technique increased running distance, decreased post run ICP, and improved self-reported measures regarding function.

Packer, J.D., Day, M.S., Nguyen, J.T., Hobart, S.J., Hannafin, J.A., & Metzl, J.D. (2013). Functional outcomes and patient satisfaction after fasciotomy for chronic exertional compartment syndrome. *The American Journal of Sports Medicine, 41*(2), 430-6. doi:10.1177/0363546512471330

Level of Evidence: Oxford 4, PEDRO N/A

Purpose: To compare functional outcomes and patient satisfaction between non-operative and operative patients with CECS of the lower leg.

Methods: 27 non-operative and 73 operative patients with CECS in the lower leg between the years of 1999 to 2008 were selected from the Hospital for Special Surgery in New York. Patients were contacted via telephone to complete an interview including data regarding success or failure of their treatment method as defined by symptom recurrence. Patients were also asked about their personal satisfaction with their treatment method. Medical records were analyzed to obtain data regarding intracompartmental pressure (ICP) prior to surgery.

Results: The patients who underwent surgery had a higher success rate (81%) relative to the non-operative group (41%) ($p<.001$). The post-operative group had higher rates of patient satisfaction (81%) when compared to the non-operative group (56%) ($p=.011$). There was no significant correlation between ICP and patient outcomes ($p> .05$). Patients who had a fasciotomy that were post-college experienced lower satisfaction rates (66%) following surgery relative to high school students (89%) and college patients (94%) ($P=.017$). Patients who had anterior and lateral releases in combination experienced greater rates of failure (31%) relative to those who had an isolated anterior release (0%) ($p=.017$).

Conclusion: Individuals who are high school or college aged undergoing an isolated anterior compartment release are more likely to have higher rates of success and patient satisfaction following fasciotomy compared to those who utilize non-operative treatments for management of CECS of the lower leg.

Rajasekaran, S., & Hall, M.M. (2016). Nonoperative management of chronic exertional compartment syndrome: A systematic review. *Current Sports Medicine Reports, 15*(3), 191-8. doi:10.1249/JSR.0000000000000261

Level of Evidence: Oxford 3a, PEDRO N/A

Purpose: To systematically review existing literature on non-operative treatment options for CECS of the lower leg.

Methods: Researchers searched the databases of PubMed, SPORTDiscus, and Cochrane up to July 31, 2015 using the mesh terms "chronic exertional compartment syndrome" or "anterior tibial compartment syndrome". One author evaluated the title, abstract, and full text for inclusion in the study. Seven articles were selected and then further analyzed under the sub-categories of massage, gait changes, chemodenervation, and ultrasound-guided (USG) fascial fenestration. Each article was then qualitatively reviewed for critical details and outcomes regarding treatment of CECS in the lower leg. A non-operative treatment algorithm (Figure 2) for individuals with CECS in the lower leg was developed based on the findings of the studies.

Results: All studies were either case-series or case reports limiting the significance of the results. All four treatment options had few or no reported adverse implications for the patient and thus, can be considered in clinical practice. Gait changes were found to be effective for reducing symptoms of CECS at one year and USG fascial fenestration was effective at reducing symptoms at a 1.5 year follow up. If the patient is willing to temporarily cease activity, massage is an effective treatment option. The chemodenervation study lacked long term follow up making it difficult to conclude whether it is effective for management of CECS in the lower leg.

Conclusion: Non-operative treatment methods for CECS of the lower leg offer a low-risk treatment option for patients who wish to avoid surgical treatment. Higher level evidence studies are necessary before concluding the effectiveness of the discussed non-operative treatments.

Appendix B: Article Analyses

Waterman, B.R., Laughlin, M., Kilcoyne, K., Cameron, K.L., & Owens, B.D. (2013). Surgical treatment of chronic exertional compartment syndrome of the leg: Failure rates and postoperative disability in an active patient population. *The Journal of Bone and Joint Surgery. American Volume, 95*(7), 592-6. doi:10.2106/JBJS.L.00481

Level of Evidence: Oxford 2c, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes the purpose is stated in both the article's abstract as well as in the introduction. "The purpose of this study was to retrospectively review the clinical results of surgical management of chronic exertional compartment syndrome of the leg in military personnel" (pg. 593).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There is a lack of research regarding the long-term outcomes following a fasciotomy for CECS in an active patient population. Furthermore, prior studies that have been completed regarding the topic had small sample sizes.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	There are no internal validity concerns regarding attrition, instrumentation, maturation, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One possible threat is assignment/selection because the researchers could have selected only individuals from the system whose outcomes aligned with their hypothesis due to the retrospective nature of this study. Another possible threat could have been history because an array of events (i.e. patient contracts infection from hospital

➢ **Statistical Regression**	environment) that the researchers had no control of given the retrospective nature of the study could have occurred and thus, impacted surgical complications and outcomes following fasciotomy.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
1. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, subjects were not randomly assigned to treatment groups as the efficacy of only one treatment was being analyzed in this study.
2. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, there was no control or comparison group in this study.
3. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subjects were aware of the group to which they were assigned as there was only one group present in this study.
4. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of which participants they were selecting from the database. The potential consequences of this are selecting only patients whose outcomes aligned with the investigator's hypothesis and excluding those patients whose data did not align with their hypothesis.
5. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, only one group was analyzed and there was no control/comparison group.

6. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the retrospective nature of this study allowed for review of medical records over the course of 7 years, which is sufficient time to determine post-operative complications and outcomes.
7. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all the patients that were selected completed the study as it was a retrospective analysis.
8. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in this study and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

9. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **10. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	The statistical findings obtained from a univariate analysis of prognostic factors with a CI of 95% reveal that the rate of surgical failure was associated with bilateral limb involvement (OR, 1.64, p= .02), operative complications (OR, 2.12, p=.003), activity limitations (OR, 4.41, p<.0001) and the continuation of pre-operative symptoms (OR, 8.46, p<.0001) Occurrence rates within the sample regarding the outcome variables of interest are as follows: 44.7% reported a reoccurrence of symptoms following surgery, 27.7% of the sample reported being unable to return to full activity following surgery, 15.7% of the sample experienced surgical complications, 5.9% underwent revision surgery, and. The statistical findings indicate that my patient's symptomology reoccurrence is not rare and that her outcomes following surgery are common amongst an active population. These statistics indicate that when an active patient presents with these given prognostic factors for surgical failure I may want to encourage the patient to try a variety of conservative treatment options prior to electing to have a fasciotomy to resolve the CECS.
11. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There are no established minimally important differences for the outcome measures analyzed in this study.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
12. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention may be appropriate for those who have failed other conservative treatment options.
13. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	No, the subjects are primarily military males (91.8% of sample was males) and thus, this data may not be applicable to females in the general population. However, given that the military activity requires copious running and symptoms were primarily reported in relation

	to running, it may be appropriate for patients who are runners.
14. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	No, given the serious nature of the surgical complications (i.e. neurological, infection, hematoma formation) and the high rates of symptom reoccurrence (44.7%) the benefits do not appear to outweigh the risks in an active population based on this study alone.
15. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	No, the patient prefers to not have surgery unless it is the best option available. Thus, the data from this study can be used to further justify the need to explore conservative options prior to opting for an elective fasciotomy.
16. Are there any threats to external validity in this study?	Yes, the sex demographics of the population were 91.8% male and 8.2% female. Furthermore, the sample was composed of military personnel which designates a different level of physical activity than the typical active population. Thus, given the specific nature of this sample, these results may apply primarily to military males and may not be generalizable to the general patient population.

What is the bottom line?

The bottom line from this study is that in an active patient population with CECS rates of symptom reoccurrence and failure to return to full activity are high following an elective fasciotomy, especially if the patient has bilateral limb involvement, operative complications, activity limitations and the continuation of pre-operative symptoms.

Diebal, A.R., Gregory, R., Alitz, C., & Gerber, J.P. (2012). Forefoot running improves pain and disability associated with chronic exertional compartment syndrome. *The American Journal of Sports Medicine, 40*(5), 1060-7. doi:10.1177/0363546512439182

Level of Evidence: Oxford 4, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is stated in both the article's abstract as well as in the introduction. "The purpose of this study was to evaluate the effectiveness of a forefoot running technique intervention on reducing the symptoms associated with CECS" (pg. 1061).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There is no research regarding the impact of a forefoot running technique intervention on pain and disability in individuals with CECS. The researchers cited multiple studies stating that running technique is known to impact the pressure in the anterior compartment of the leg as well as studies that note decreased eccentric use of the tibialis anterior during a forefoot strike. Thus, these studies provide justification for investigating the impact of a forefoot running intervention on pain and disability in patients with CECS.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	There are no internal validity concerns regarding attrition, history, maturation, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One possible threat is instrumentation because no testing was completed to assure reliability of the orthopedic surgeon who completed the intracompartmental pressure measures using a side-port needle. Another potential threat is selection in that because

➢ **Compensatory rivalry** ➢ **Statistical Regression**	this study was prospective the researchers had the freedom to create inclusion criteria in such a manner that they knew the participants would benefit from the intervention being tested.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
17. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, subjects were not randomly assigned to treatment groups as this study had a prospective case series design.
18. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, there was no control or comparison group in this study. Demographics of the ten participants was reported.
19. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subjects were aware of the group to which they were assigned as there was only one intervention group present in this study.
20. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of which participants they were selecting from the military academy who fit their inclusion criteria. The potential consequences are that the researchers may have selected only patients with characteristics that would lend to favorable results following the intervention.
21. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, only one group was analyzed and there was no control/comparison group.
22. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?	Yes, the follow up time of 6 weeks was sufficient to answer the question posed by the research. However, it would be beneficial to

a. If not, what are the potential consequences of this knowledge for the study's results?	have taken the quantitative data measures again at 12 weeks and one year to see the long term impacts of the forefoot running intervention.
23. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all ten patients that were selected completed the intervention.
24. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in this study and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

25. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **26. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Statistical findings revealed that mean anterior compartment pressure postrun decreased significantly from 78.4 ± 32 mmHg at baseline to 38.4±11.5 mmHg (p=.001). Running distances increased from a baseline measure of 1.4± 0.6km to 4.8±0.5km (p<.001) following the intervention. VAS scores decreased significantly from 71.3± 7.9mm to 2.7± 5.1mm (p<.001). Step length and contact time decreased significantly (p<.05). Step rate increased significantly (p<.05). Vertical GRF, impulse, and weight acceptance rate significantly decreased (p<.05). SANE scores increased significantly from 49.9 ± 21.4 to 90.4 ±10.3 at 6 week follow up and 93.8 ± 11 at the one year follow up (p<.001). LLOS scores increased significantly from 67.3± 13.7 to 91.5 ± 8.5 at the 6 week follow up and 94.2± 8.2 at the one year follow up (p<.001). No confidence intervals were reported in this study. Because my patient is a hind foot striker and a runner, these statistical findings indicate that implementing a 6-week forefoot running intervention could potentially reduce her pain, increase her running distance, and decrease her disability. However, the sample size of this study is small, so the power of these statistics is limited and thus, must be considered when interpreting the statistical significance of these findings.
27. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The values for minimally clinically important difference on the pain VAS, LLOS, and SANE for the CECS population has not been researched. I will use this evidence because clinical judgment allows me to decipher that up to 40 point changes in pain VAS scores and increasing running distances by up to 3.4km would be meaningful to the patient.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***

28. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention is feasible as it was performed for 45 minutes three times a week for the course of 6 weeks with minimal equipment. Thus, it is cost effective and could easily be incorporated into a treatment session.
29. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	No, eight out of the ten patients were males. However, the patients were similar in age to my patient (mean age 20.2 years). Furthermore, the subjects were recruited from the U.S. Military Academy, meaning that they are likely involved in training that my patient does not perform. I would still use this intervention in spite of the differences given the simple nature of the intervention and the long term effectiveness of the intervention.
30. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes, the potential benefits outweigh the potential risks of using this intervention. The primary risk would be exacerbating the symptoms of CECS, while the benefits would be avoiding surgery, allowing for the continuation of activity participation, and providing a long-term solution to decrease or at least manage symptoms.
31. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, the patient is open to altering her running style and would like to avoid revision surgery.
32. Are there any threats to external validity in this study?	Yes, the population was composed of individuals from the U.S. Military Academy and was primarily male (80%). Thus, the results of the study may not apply to the general running population with CECS. Furthermore, this study utilized those with only CECS in the anterior compartment of the lower leg. Consequently, the results may not be valid for those with CECS in the lateral or posterior compartments of the lower leg.

What is the bottom line?

The bottom line from this study is that a 6-week forefoot strike running intervention has the potential to reduce anterior compartment pressure, decrease pain and disability, increase running distance, and allow for the avoidance of surgery in an active running population with CECS in the anterior compartment.

Drexler, M., Rutenberg, T. F., Rozen, N., Warschawski, Y., Rath, E., Chechik, G., Rachevsky, G., & Morag, G. (2017). Single minimal incision fasciotomy for the treatment of chronic exertional compartment syndrome: Outcomes and complications. *Archives of Orthopaedic and Trauma Surgery : Including Arthroscopy and Sports Medicine,137*(1), 73-79. doi:10.1007/s00402-016-2569-7

Level of Evidence: Oxford 4, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's introduction. "The purpose of this study is to report the results and complications of a single minimal incision fasciotomy on a large cohort with a long follow-up" (pg. 74).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Yes, the article stated that previous articles regarding outcomes following fasciotomy include small sample sizes and short term follow ups. Thus, this article wanted to see outcomes in a larger sample size and with a longer follow up to see if patients were still satisfied with the procedure long term.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	There are no internal validity concerns regarding attrition, history, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is maturation because this study was completed retrospectively and there was no report or way to control for other interventions that the patient may have used to manage their CECS aside from the surgery. Thus, this could be a potential confounding variable for the satisfaction rates.

➢ **Compensatory rivalry** ➢ **Statistical Regression**	Another possible threat is instrumentation because the telephone interviews were not completed by the same person and thus could provide varying results. Furthermore, the patients were asked to estimate their pre-operative pain and data for the outcome measures, which could lead to inaccurate results regarding changes in those outcome measures especially in those who had the surgery completed several years ago.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
33. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, subjects were not randomly assigned to treatment groups as this study had a retrospective case series design.
34. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, there was no control or comparison group in this study. Demographics of the fifty-four patients were reported (Table 1).
35. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subjects were aware of the group to which they were assigned as there was only one intervention group present in this study.
36. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of which participants they were selecting from the medical record base at Tel Aviv Sourasky Medical Center. The potential consequences are that the researchers may have selected only patients with characteristics that would lend to favorable results following the surgery.
37. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this**	Yes, only one group was analyzed and there was no control/comparison group.

knowledge for the study's results?	
38. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the mean follow up time in this study was 50.1 months (4.6 months to 97.5 months), which is currently the longest follow up period for patients with CECS who had fasciotomy.
39. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all fifty-four patients that were selected completed the intervention.
40. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in this study and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

41. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **42. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Findings of the study revealed that satisfaction rates following surgery were 75.5% with major complications including wound infection (2.1% of patients) and nerve damage (4.2% of patients). Of the 54 patients who underwent surgery, 8 patients (8.4%) experienced recurrence of symptoms. Average pre-operative Tegner score was 79 (SE 1.18, median 80) with the average post-operative Tegner score being 93.6 (SE 1.35, median 14). Average change in Tegner score was 14.6 points (SE 1.52, median 14). SF-12 and NAS scores significantly improved following the surgery ($p<.05$). Specific numerical data for SF-12 and NAS scores were not reported in the study. There was no correlation between the level of satisfaction following the surgery and the level of activity reported by the patient (P=0.332), the patient's age (P=.339), or the type of activity (P=0.630). No confidence intervals were reported. These results indicate that in an athletic population, the single minimal incision fasciotomy may be a feasible treatment option to discuss with a patient if the patient fails conservative treatment and desires to have the operation as satisfaction rates are relatively high and complication rates are relatively low. However, there was no control group and this is a retrospective study with many design flaws, so these statistics need to be interpreted with caution.
43. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	Minimally important differences for the NAS pain scale, Tegner scores, and SF-12 have not been established in patients with lower leg pain or individuals with CECS. Without numerical data to analyze for the NAS pain scale or the SF-12 scores, it is difficult to decipher whether or not the changes are meaningful for the patient. However, a satisfaction rate of 75.5% with an average follow up of 50.1 months is relatively significant in terms of patient satisfaction.

Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
44. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention is not feasible in my clinical setting. However, it is a feasible option to discuss with patients if they have failed conservative treatment and desire to pursue surgical options. It is not the most cost effective option given that it is an elective surgical procedure.
45. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The patients are relatively similar to my patient in that the majority of the patients were runners (35) with a mean age of 23.63 years. However, the majority of the sample was males (49) with only four females being in the study. Also, the study was completed using a sample from Israel. Thus, these results may not be particularly relevant to my patient, but may be applied to her case with caution.
46. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	No, the potential benefits do not outweigh the risks in this case. CECS is a condition in which the person can live a functional life. While only 7.4% of patients experienced nerve damage and only 3.7% of patients experienced wound infection, these are serious complications that can alter function in the patient. Thus, I would only use this intervention if the patient had failed all conservative interventions and desired to pursue this option.
47. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	No, the patient would like to avoid a revision surgery if possible. Thus, I will pursue research into more conservative methods to see what options we can pursue for her treatment before looking into a revision surgery.
48. Are there any threats to external validity in this study?	Yes, the population was composed of individuals from Israel and primarily males (92.5%). Thus, the results of the study may not be as applicable for females and for the general population with CECS in other countries.

What is the bottom line?

The bottom line from this study is that single minimal incision fasciotomy results in relatively high success rates with relatively low surgical complication rates long term amongst young athletic individuals with CECS.

Collins, C.K., & Gilden, B. (2016). A non-operative approach to the management of chronic exertional compartment syndrome in a triathelete: A case report. *International Journal of Sports Physical Therapy, 11*(7), 1160-1176.

Level of Evidence: Oxford 4, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's abstract and introduction. "The purpose of this case report is to describe a non-operative, comprehensive approach to physical therapy, Functional Manual Therapy (FMT) in the treatment of a competitive triathlete with bilateral CECS who did not desire surgery" (pg. 1162).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Yes, the article states that there is a lack of research regarding the effects of conservative treatment methods in individuals with CECS who do not desire to have surgery. Furthermore, the article says that no cases examining the impact of a comprehensive rehabilitation program for the management of CECS have been published prior to this study. Thus, there is a need for this study and future studies with larger sample sizes addressing this topic.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	There are no internal validity concerns regarding assignment, attrition, history, instrumentation, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is maturation because the patient may have experienced tissue healing and a reduction in CECS symptoms as a byproduct of the passage of time and decreasing activity levels temporarily. Thus, it is difficult to ascertain whether the results experienced by this patient are the direct

➢ **Compensatory rivalry** ➢ **Statistical Regression**	effect of the intervention. Also, it must be noted that this is a sample size of one, which means that the treatment was able to be adapted to that specific patient's needs and is not necessarily standardized as is needed for research methodology.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
49. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, there was only one subject as this was a case report.
50. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, there was no control or comparison group in this study. The patient's demographics are discussed in detail in the subject history section (pg. 1162).
51. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subject was aware of the treatment which she was going to receive. Thus, the placebo effect could occur due to the patient believing they would get better because they were being treated.
52. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware as there was only one patient being treated. The potential consequences are the researchers may have selected a patient which they believed would respond well to an FMT approach for CECS for the case report.
53. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, only one patient was involved in the study. Thus, this is not a concern in this study.

54. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the patient's objective measures were obtained following the intervention at 3.5 months, subjective data was obtained from the patient at 6 months, and subjective information along with the GRC was administered at 3 years following the intervention.
55. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, the one patient enrolled in the study completed the full intervention.
56. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in this study and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

57. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **58. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Given that this is a case report, n=1 and no statistics were completed. Thus, outcome measures along with subjective report are the primary results of this study. The patient reported 2/10 pain on the NPRS that did not cause cessation of running as compared to the 7/10 pain with two miles of running she felt prior to treatment which caused her to stop running. The patient trained and ran in an Olympic distance triathlon 6 months following the treatment. LEFS score increased from 62 at baseline to 80 following the intervention. Compartment pressures at rest in the left lower extremity improved from 36 mmHG (deep posterior), 36-38mmHg (superficial posterior), and 25 mmHg (anterior) to 11mmHg (deep posterior), 8mmHg (superficial posterior), 19mmHg (anterior) following the intervention. Three years following the intervention, the patient reported a GRC of 6 and stated she was pain-free. These results must be interpreted with caution due to the sample size being one. However, given the lack of evidence along with the patient being a female runner, these results mean that implementing a FMT approach could allow my patient to return to running with limited pain and decrease her compartment pressures at rest. Furthermore, the impact of the intervention was long term for this patients as at 3 years follow being pain-free with a GRC of 6 is a significant finding. Thus, it provides a feasible and detailed intervention option for both this patient and future similar patients with this condition.
59. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The patient's change on the LEFS was 18 points, which exceeds the established 9 point MCID and MDC (Binkley et al.,1999). While the MCID for the NPRS has not been established for individuals with CECS, in patients with chronic musculoskeletal pain the MCID is one point (Saliffi et al., 2004).

	Thus, this patient's change of 5 points on the NPRS is significant.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
60. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention is appropriate for use in my clinical setting. It utilized primarily manual techniques with joint mobilizations and motor control exercises that require minimal equipment. Furthermore, it was delivered 1-2X/wk over the course of 3.5 months, which is reasonable for insurance coverage purposes. Thus, this intervention is both affordable and feasible within a physical therapy clinic.
61. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The patient was similar to my patient in that she was a female who ran. She is also a triathlete meaning that she engages in other activities that my patient does not, but her pain was primarily reported during running after two miles, which aligns with my patient's presentation. She was also 34 which makes her ten years older than my patient and she did not already have a fasciotomy completed. In spite of the differences, I would utilize the intervention as it presents a patient that is very similar to my patient.
62. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes, the potential benefits outweigh the risks of using this intervention with my patient. The risks include a worsening of symptoms, poor response to joint mobilizations, integumentary reactions to the manual therapy, and soreness from strengthening and motor control exercises. The benefits include decrease of symptoms, ability to return to activity, and avoidance of surgery. Thus, it is worth implementing this intervention with my patient if she desires to try the intervention.
63. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, the patient would like a conservative treatment option for managing her symptoms and this provides an alternative treatment option to surgery.
64. Are there any threats to external validity in this study?	Yes, the primary threat to external validity is that this is a case report and consequently the sample size is one. Thus, the results would

	only apply to individuals with similar characteristics to the patient examined in the case report.

What is the bottom line?

The bottom line from this study is that in a competitive 34-year-old female triathlete, a Functional Manual Therapy intervention was successful in managing CECS symptoms and allowing her to return to her sport.

Winkes, M.B., Hoogeveen, A.R., & Scheltinga, M.R. (2014). Is surgery effective for deep posterior compartment syndrome of the leg? a systematic review. *British Journal of Sports Medicine, 48*(22), 1592-1598. doi:10.1136/bjsports-2013-092518

Level of Evidence: Oxford 3a, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's abstract and introduction. "The purpose of this systematic review was to provide a critical analysis of existing literature on the surgical management of dp-CECS aimed at identifying parameters determining surgical results" (pg. 1592).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Yes, the article states that the outcomes following fasciotomy for treating individuals with deep posterior CECS vary and that it is unknown what factors influence the varying rates of success following surgery. Thus, this study looks to identify actual success rates of fasciotomy within the literature and seeks to identify factors that make an individual with CECS more at risk for failed outcomes following surgery.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	There are no internal validity concerns regarding assignment, instrumentation, attrition, history, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is selection as the systematic review notes that the studies selected each utilized a different surgical technique. Thus, it is difficult to compare outcomes of each study and deduce conclusions about outcomes of fasciotomy for posterior CECS, especially since there were only seven studies included in the review.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
65. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, each of the studies included in the systematic review were grade 3 evidence, meaning that random assignment was not completed and there were no control groups in any of the seven studies.
66. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, there was no control or comparison group in any of the included 7 studies. Demographic data on the patients in the 7 studies is included in Table 4 (pg. 1595). The groups analyzed were relatively similar regarding demographics. However, there was variation on the ratios of male to female in each study and variation on pressure criteria used to diagnosis CECS. No information regarding patient ages was included. Thus, it is difficult to assess whether it is fair to compare the outcomes in each article to one another.
67. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the participants were aware of the surgery they were going to receive in all cases. Regarding this study, this most likely had no impact on the results of the study as it was retrospectively addressing outcomes following surgery.
68. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of who being assigned to which group prior to the allocation in each of the studies. It must be noted that the surgeon(s) involved in the procedure typically publish the studies and consequently may include only patients whose outcomes align with their hypothesis.
69. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	No, there was noted variation in surgical technique and post-operative protocols amongst the studies. Thus, it is difficult to ascertain whether comparing studies and composing cumulative rates of failure and success from studies that vary in procedure is valid.

70. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the shortest follow up was 6 months while the longest follow up was 4 years. Thus, there was a range in the length of follow up data that was sufficient to understand outcomes following fasciotomy for individuals with posterior CECS.
71. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all patients enrolled in each of the studies completed the study.
72. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in the included studies and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

73. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI**	Statistical findings of the study revealed that there was no difference in success rates between men and women (p=0.59). Intracompartmental pressure (ICP) immediately following exercise (OR 1.06, 95% CI) and a decrease in ICP 5 minutes following exercise (OR 1.11, CI 95%) were associated with success following surgery. Other quantitative findings from the study were that success rates following surgery ranged from 30% to 65%. Two of seven studies reported recurrence of symptoms, with recurrence rates ranging from 33.33% to 40%. Two of seven studies reported all patients returned to running pain-free. Complication rates were not reported in any of the included studies
74. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?	Because my patient does have CECS in the posterior compartment (as well as the anterior and lateral compartments), these statistics indicate that if my patient has a higher ICP immediately following exercise that effectively decreases 5 minutes following exercise she would be more likely to have a successful outcome following surgery and that her being a female should not influence the outcome. However, the success rates are modest and with recurrence rates being relatively moderate it indicates that she may want to pursue conservative treatment methods initially.
75. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There are no MCIDs for any of the data presented in this systematic review. However, recurrent of 33.33% to 40% and success rates of 30% to 65% are significant when it comes to the patient considering whether or not they desire to have an elective fasciotomy for CECS.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
76. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention is not appropriate for use in my clinical setting as it is not within my scope of practice. However, this study

	presents data on treatment options and outcome data to discuss with the patient should they desire to pursue an elective fasciotomy for their CECS.
77. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The subjects are relatively similar to my patient because the sex ratios were split equally amongst the studies. However, no data regarding ages of the patients included in the studies was provided. Furthermore, while my patient does have posterior CECS, she also has involvement within her anterior and lateral compartments, making these results less applicable to her case. Despite the differences, the data of this study can be utilized in assisting my patient to decide whether to have a revision surgery for her symptoms.
78. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	No, the potential risks of surgery can include serious complications such as infection, DVT, hematomas, sensory changes, and neurological weakness. Furthermore, with this study presenting modest success rates and moderate recurrence of symptom rates that makes the potential of surgery having unsuccessful outcomes relatively high. While the benefits include resolution of symptoms and return to activity, this study implicates that the patient should consider conservative treatment options before electing to have surgery for her CECS.
79. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	No, the patient desires to avoid revision surgery if possible. Thus, I will investigate feasible conservative treatment methods and their outcomes to best serve my patient and her desires.
80. Are there any threats to external validity in this study?	Yes, the primary threat to external validity is that while collectively the studies make a large sample size of 131 patients, each study on its own has a small sample size, limiting the power of its statistics and generalizability to the population.

What is the bottom line?

The bottom line from this study is that success rates and recurrence of symptoms following fasciotomy for individuals with posterior compartment CECS are variable and that a surgical technique for posterior CECS has not been standardized.

Helmhout, P.H., Diebal, A.R., van der Kaaden, L., Harts, C.C., Beutler, A., & Zimmermann, W.O. (2015). The effectiveness of a 6-week intervention program aimed at modifying running style in patients with chronic exertional compartment syndrome: Results from a series of case studies. *Orthopaedic Journal of Sports Medicine, 3*(3). doi:10.1177/2325967115575691

Level of Evidence: Oxford 4, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's abstract and introduction. "Our primary purpose was to evaluate the effectiveness of a 6-week intervention program aimed at changing running technique in Dutch military service members with CECS of the lower legs" (pg. 2).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	The study cites Diebal et al. (2012) as the framework for implementing a forefoot running intervention. It states that it seeks to build upon this work by using a non-US military sample and by using a program that is 50% home based and 50% center based.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	There are no internal validity concerns regarding assignment, attrition, history, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is instrumentation because the primary outcome measures of this study were self-report measures. Thus, the patients could have simply perceived themselves as "getting better" simply due to having received treatment of any sort and thus, there scores could have improved regardless of the treatment delivered.

➢ **Statistical Regression**	Furthermore, there was no mention of who took the ICP measures at either baseline or post-intervention and thus, the reliability of these measures could be questionable.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
81. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, each subject completed the same intervention program. There was no control group in this prospective cohort study. Without a control group, it is difficult to determine whether these same results would have occurred because of the passage of time alone or if they are a byproduct of the intervention.
82. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	There was no control/comparison group in this study. The demographics of the participants are reported in Table 1. It should be noted that the sample was primarily male (18) with only 1 female participant.
83. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the participants were aware of the treatment group that they were assigned to as there was only one group in this study. The consequences are that the participants may have believed simply because they are receiving treatment that they would get better and with no control group to compare to it's difficult to come to conclusions regarding the treatment's effectiveness.
84. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of who was assigned to the treatment group as all participants were part of the treatment group. The consequences of this are the researchers could have selected only individuals who they believed would respond well to the intervention.
85. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, because there was only one treatment group in this study they all received the same treatment.

86. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the follow up was sufficient to determine the effects of a 6-week forefoot running intervention in individuals with CECS. For all 19 patients in the sample, follow up was completed at 6 weeks (immediately following the intervention) and long term data was collected from 14 of the patients at 4 months.
87. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all patients enrolled in the study completed the intervention. 5 of the 19 patients did not complete the 4 month follow up.
88. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was no control/comparison group in the included studies and thus, an intention to treat analysis was not completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

89. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI**	Post-intervention running distance had a mean increase of 43% and post-run ICP had a mean decrease of 36%. From pre-intervention to post intervention, SANE scores improved by 36% ($p<05$, CI 95%), LLOS improved by 18% ($p<.05$, CI 95%), and PSC improved by 60% ($p<.05$, CI 95%). Mean GROC post intervention was 4+ to 5+ ("somewhat better" to "moderately better"). At four months following the intervention, the SANE scores improved by 48% ($p<.05$, CI 95%), LLOS improved by 26% ($p<.05$, CI 95%), and PSC improved by 81% ($p<.05$, CI 95%). GROC scores improved to 6+ ("a great deal better") at 4 month follow up.
90. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?	These statistical findings indicate that implementing a 6-week forefoot running intervention with both center and home based components could effectively help my patient increase her running distance, decrease her ICP post run, and improve her perception of her condition. However, these statistics should be interpreted with caution due to the small sample size (n=19) and lack of a control group.
91. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	No MCIDs have been established for the SANE, LLOS, PSC, and GROC in individuals with LE conditions or with CECS. However, increasing running distance by 43% and experiencing a decrease in post run ICP of 36% while not being statistically significant could have significant implications for the patient regarding returning to activity and management of their symptoms. Thus, I will still use this evidence.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
92. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention sounds appropriate for my clinical setting as it requires minimal equipment (therapist, metronome, basic exercise equipment) making it cost effective. Also, it had a home-based component which would be effective for long term management and the clinic portion was delivered 3X/wk

	for 60 minutes, making it feasible to be covered by insurance companies as a treatment method.
93. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The subjects are not similar to my patient as they were primarily Dutch military males (18 males, 1 female). However, the mean age of the participants was 24.5 years which is similar to my patient's age. Also, part of the exclusion criteria was that they could not have had a fasciotomy performed prior to treatment, which differs from my patient. Despite these differences, the treatment would still be worthwhile to try due to its ease of implementation and cost effective nature.
94. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes, the potential risks are making the patient's symptoms worse or that she does not improve at all. The potential benefits are improvement or management of her CECS symptoms, ability to increase the distance she runs, and a decrease in post run ICP.
95. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, the patient desires a conservative treatment method, especially one that allows her to continue running.
96. Are there any threats to external validity in this study?	Yes, this study was completed on primarily male Dutch military members making it applicable to a very specific population and not generalizable to the general population. Furthermore, the sample size was small (n=19), which further limits its generalizability.

What is the bottom line?

The bottom line from this study is that in 19 Dutch military members a 6-week center and home based intervention designed to promote a forefoot running technique increased running distance, decreased post run ICP, and improved self-reported measures regarding function.

Packer, J.D., Day, M.S., Nguyen, J.T., Hobart, S.J., Hannafin, J.A., & Metzl, J.D. (2013). Functional outcomes and patient satisfaction after fasciotomy for chronic exertional compartment syndrome. *The American Journal of Sports Medicine, 41*(2), 430-6. doi:10.1177/0363546512471330

Level of Evidence: Oxford 4, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's introduction. The purpose of this study was to compare functional outcomes and patient satisfaction between non-operative and operative patients with CECS of the lower leg.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	The study states that previous research regarding outcomes following fasciotomy include small samples sizes, use varying surgical techniques, and have a variety of outcome measures. Thus, this study seeks to address outcomes following a fasciotomy in a large sample and by using a telephone interview assessing success and failure and patient satisfaction as the primary outcome measure.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	There are no internal validity concerns regarding assignment, attrition, history, testing, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is instrumentation as the telephone interviews were conducted by multiple interviewers. Thus, there could have been variation in delivery of the interview and the interpretation of the interviewer could influence the results. Maturation may also be a potential threat because the patient's may have experienced resolution of their

➢ **Statistical Regression**	symptoms because of time alone and not as a direct result of surgical intervention.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
97. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, this study was a retrospective analysis, thus, there was no random assignment of participants to the groups being compared. Given that it was retrospective, this designates a lack of control of the types of participants utilized in the study, which means that there could be confounding variables present in the sample demographics utilized for the study.
98. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No, the groups were not similar. The surgery group is significantly larger (n=73) relative to the non-operative group (n=27). There surgery group had a larger amount of females (71%) relative to the non-operative group (59%). Furthermore, there was great variation among the description of symptoms between the two groups (i.e. pain vs. numbness vs. weakness).
99. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the participants were aware of the treatment group that they were assigned to as this was a retrospective study that analyzed the outcomes of the two interventions relative to each other. Given that this study is retrospective, awareness of the treatment group most likely did not impact the results of this study.
100. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of who was assigned to the treatment group as the study was retrospective and the participants were selected from a database. Because they were not blind and selected the patients from a database, they may have selected patients whose data aligned with their hypothesis and excluded those with data that contradicted their hypothesis.
101. Were the groups managed equally, apart from the actual experimental treatment?	Yes, because this study was retrospective, each group was given the same telephone

a. If not, what are the potential consequences of this knowledge for the study's results?	interview and their medical records were assessed for the same data.
102. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Yes, the follow up was sufficient to determine the effects of surgery and non-operative treatment methods as the average follow up time for the surgery group was 5.2 years and for the non-operative group average follow up time was 5.6 years.
103. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all patients enrolled in the study completed the intervention as this was a retrospective study.
104. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Yes, all patients were analyzed in the groups they were assigned to and there was not an intention to treat analysis completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

105. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **106. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Statistical findings revealed that the patients who underwent surgery had a higher success rate (81%) relative to the non-operative group (41%) (p<.001). The post-operative group had higher rates of patient satisfaction (81%) when compared to the non-operative group (56%) (p=.011). There was no significant correlation between ICP and patient outcomes (p> .05). Patients who had a fasciotomy that were post-college experienced lower satisfaction rates (66%) following surgery relative to high school students (89%) and college patients (94%) (P=.017). Patients who had anterior and lateral releases in combination experienced greater rates of failure (31%) relative to those who had an isolated anterior release (0%) (p=.017). These statistical findings indicate that because my patient is a post-college aged individual who would require both an anterior and lateral compartment release, her outcomes following surgery would most likely not be favorable. In the case of my clinic, these findings indicate that if an individual is college aged or younger and only requires an isolated anterior compartment release, surgery outcomes following fasciotomy would most likely be favorable.
107. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	No MCIDs exist for the outcome measures utilized in this study. However, success rates of 81% in the surgical group as opposed to 41% in the non-operative group have significant implications for the patient when it comes to deciding if they desire to have surgery to manage their CECS symptoms depending on if their demographics align with the sample demographics of this study.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
108. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The non-operative intervention method would be appropriate for use within my clinic. However, the surgical intervention is not

	within my scope of practice and thus, is impractical. However, this study provides data to inform the patient about when they are trying to determine whether or not to pursue having a fasciotomy to manage their CECS symptoms.
109. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The subjects in both groups were relatively similar to my patient. The surgical group was primary females with an average age of 26.3 years and 71% had bilateral CECS, thus making them relatively similar to my patient. The non-operative group was approximately half females with an average age of 31 years and primarily bilateral CECS. Thus, the findings of the surgical group are relatively more useful in the case of my patient based on the premise of age.
110. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	No, the potential risks of surgery do not outweigh the risks associated with the operation. Neurological weakness, hematomas, infection, DVT, and sensory deficits are all serious complications that could occur because of surgery. Furthermore, symptom recurrence could occur after having the fasciotomy. The potential benefits are resolution of the CECS symptoms and return to full activity.
111. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	No, the surgical treatment option does not align with my patient's values as she does not desire to have a revision surgery unless it is the best treatment option. The non-operative treatment does align with my patient's values. Thus, I will utilize that data and further investigate the outcomes of conservative treatment methods.
112. Are there any threats to external validity in this study?	Yes, this study was completed utilizing a sample from only one hospital in New York and thus, the outcomes may not be generalizable to individuals who have fasciotomies complete at other hospitals across the country and around the world.

What is the bottom line?

The bottom line from this study is individuals who are high school or college aged undergoing an isolated anterior compartment release are more likely to have high rates of success and patient

satisfaction following fasciotomy compared to those who utilize non-operative treatments for management of CECS of the lower leg.

Rajasekaran, S., & Hall, M.M. (2016). Nonoperative management of chronic exertional compartment syndrome: A systematic review. *Current Sports Medicine Reports, 15*(3), 191-8. doi:10.1249/JSR.0000000000000261

Level of Evidence: Oxford 3a, PEDRO N/A

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose is clearly stated in the article's introduction and abstract. "The objective of this study was to systematically review the literature for non-surgical treatment options for CECS of the lower leg" (pg. 191).
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	The study states that non-operative treatment is often cited as a treatment option for individuals with CECS in the lower leg, but there are previous no systematic reviews about the topic. Thus, this study seeks to address the gap in the research by systematically reviewing the existing literature about non-operative methods for CECS in the lower leg.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	There are no internal validity concerns regarding assignment, attrition, history, testing, maturation, compensatory equalization of treatments, statistical regression, or compensatory rivalry. One potential threat is instrumentation of the systematic review because only one researcher analyzed and selected the articles utilized in the study. There was no designation of exclusion criteria in the study. Thus, this indicates that studies were selected based on the expert opinion of one researcher, which may have resulted in biased selection of articles.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
113. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, this was a systematic review of case-series and case-reports. Thus, there was no random assignment of participants in any of the included studies. This indicates that these studies are lower levels of evidence with low levels of control and that the significance of their results is limited by methodology.
114. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No formal analysis of the subject demographics amongst studies was noted. Thus, it is difficult to conclude whether the samples used in each study were similar. This makes it challenging to ascertain which patient population these results would be applicable beyond the diagnosis of CECS in the lower leg.
115. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the participants were aware of the treatment group that they were assigned to because all studies were case-series or case reports, indicating that there were no control groups and no blinding. The potential consequences are that receiving any form of treatment would have helped them improve due to the patient's belief that the treatment would work. Without a control group, it is difficult to establish whether the effects would have been seen regardless of treatment.
116. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the investigators were aware of who was assigned to the treatment group as all studies included within the systematic review were case-series and case reports. The consequences are the investigators may have selected patients who would be more likely to produce results that would align with their hypotheses.
117. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	No, each study had a different treatment method meaning that each patient would have been managed differently. However, regarding the systematic review, only one author was critically analyzing each article indicating that analysis of each article was most likely performed in a similar manner.

118. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	In the cases regarding gait changes, USG, and massage studies follow up time was sufficient (5 weeks to 1.5 years). The chemodenervation did not complete a long term follow up making it difficult to understand the long term implications in regards to its ability to manage CECS symptoms of the lower leg.
119. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all patients enrolled in each of the studies completed their respective interventions.
120. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Yes, all patients were analyzed in the groups they were assigned to and there was not an intention to treat analysis completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***

121. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **122. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	No meta-analysis was completed in this systematic review due to the low quality of evidence of the included studies. Qualitative conclusions were made based on the results of each individual study. All studies included were case-series or case reports limiting the significance of the results. All four treatment options had few or no reported adverse implications for the patient and thus, can be considered in clinical practice. Gait changes were found to be effective for symptom reduction of CECS at one year and USG fascial fenestration was effective for symptoms reduction at 1.5 years following treatment. If the patient is willing to temporarily cease activity, massage is an effective treatment option. The chemodenervation study lacked long term follow up making it difficult to conclude whether it is effective for management of CECS in the lower leg. A nonoperative treatment algorithm was developed using study data (Figure 2). This qualitative data indicates that gait changes and USG fascial fenestration may produce the most promising long term results regarding symptom management in the case of my patient. Furthermore, they indicate that there is little harm in trying conservative methods for the treatment of her CECS in the lower leg. This study provides an array of options for the patient to choose from giving them more autonomy regarding their treatment. For my clinical practice, Figure 2 provides a tool by which to determine which nonoperative treatment would be most effective for a given patient.
123. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	Given that all the conclusions are qualitative, there is no way to determine if the included interventions provide a minimally important difference. However, long term management of symptoms at 1 year to 1.5 years using the gait changes or USG fascial fenestration are significant in regards to long term management of the CECS for the patient.

Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
124. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The gait changes and massage techniques are appropriate for my clinical setting as they both require minimal equipment and are affordable. However, the USG fascial fenestration and chemodenervation interventions are both outside of my scope of practice.
125. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	There was no breakdown of patient demographic provided in the article. Thus, it is difficult to ascertain to what extent the samples of each study were similar to my patient. Due to the lack of evidence regarding conservative treatment options for CECS of the lower leg, I will still utilize this intervention as no other evidence is currently available.
126. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes, the potential benefits of symptom reduction and management outweigh the risks of the conservative treatments documented in this systematic review. The most serious complication noted was increased intracompartmental pressure following the chemodenervation intervention. However, with chemodenervation, there is the inherent risk that it could spread to areas not intended for treatment and thus, produce unwanted weakness, which must be considered when choosing this option.
127. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, my patient desires conservative interventions for treating her CECS.
128. Are there any threats to external validity in this study?	Yes, the sample sizes of each study were small (ranging from n=1 to n=35) indicating that the results may not be applicable to the general population.

What is the bottom line?

The bottom line from this study is that non-operative treatment methods for CECS of the lower leg offer a low-risk treatment option for patients who wish to avoid surgical treatment.