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Effects of physical exercise to treat ulcerated and non-ulcerated chronic venous insufficiency: systematic review

Efeitos do exercício físico no tratamento da insuficiência venosa crônica ulcerada e não ulcerada: revisão sistemática

Efectos del ejercicio físico para el tratamiento de la insuficiencia venosa crónica ulcerada y no ulcerada: revisión sistemática

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Abstract
The chronic venous insufficiency (CVI) is defined as alteration on the venous flow, caused by malfunction of the venous valves, obstruction of vases and weakness of the sural triceps muscle. The physical exercise is being studied as a form of treatment of this disease to be considered of low cost and easy access. Objective: The aim was to analyze the effects of different types of physical exercise in the venous hemodynamics, muscular function and in the quality of life of individuals with CVI ulcerated and non-ulcerated. Method: The articles were obtained by a research on six data bases. were included articles in which the exercise was a form of intervention in patients with CVI. Results: Were founded 2.297 clinical trials randomized and non-randomized, nine were included. These studies applied different protocols of exercise, that were an association of mobility, strength, force, and aerobic exercises. This association showed improvement in the different clinical conditions of the CVI, and a positive impact their quality of life. Conclusion: The physical exercise is benefic to patients with CVI, being able to reduce symptoms, increase quality of life and prevent the progression of the diseases, could reduce the cost to the health systems.
Keywords: Venous insufficiency; Exercise; Quality of life; Health teaching.

Resumo
A insuficiência venosa crônica (IVC) é definida por alterações do fluxo venoso, causado por disfunção das válvulas venosas, obstrução dos vasos e fraqueza do músculo tríceps sural. O exercício físico está sendo estudo como forma de tratamento por ser considerado de baixo custo, fácil acesso. Objetivo: analisar os efeitos de diversas técnicas de exercício físico na hemodinâmica venosa, na função muscular, na qualidade de vida, e na melhora clínica de indivíduos com insuficiência venosa crônica ulcerados e não ulcerados Metodologia: artigos científicos foram obtidos por uma pesquisa em seis bancos de dados, foram incluídos artigos em que o exercício foi uma intervenção em paciente com IVC. Resultados: Foram identificados 2.297 ensaios clínicos randomizados e não randomizados, sendo nove estudos incluídos. Esses estudos aplicaram diferentes protocolos de exercício, associando exercícios de mobilidade, alongamento, força e aeróbico. A associação de exercício demonstrou uma melhora em diferentes condições clínicas da IVC e um impacto positivo na qualidade de vida desses pacientes. Conclusões: O exercício

físico é benéfico para pacientes com IVC contribuindo na redução dos sintomas, no aumento da qualidade de vida e prevenindo a progressão da doença, podendo reduzir custos para sistema de saúde.
Palavras-chave: Insuficiência venosa; Exercício físico; Qualidade de vida; Ensino em saúde.

Resumen
La insuficiencia venosa crónica (IVC) se define como la alteración del flujo venoso, ocasionada por mal funcionamiento de las válvulas venosas, obstrucción de vasos y debilidad del músculo tríceps sural. El ejercicio físico está siendo estudiado como una forma de tratamiento de esta enfermedad al ser considerada de bajo costo y fácil acceso. El propósito de esta revisión sistemática fue analizar los efectos de diferentes tipos de ejercicio físico en la hemodinámica venosa, la función muscular y en la calidad de vida de individuos con IVC ulcerada y no ulcerada. Método: Los artículos fueron obtenidos por investigación en seis bases de datos. se incluyeron artículos en los que el ejercicio fue una forma de intervención en pacientes con IVC. Resultados: Se encontraron 2.297 ensayos clínicos aleatorizados y no aleatorizados, siendo nueve incluidos en esta revisión. Estos estudios aplicaron diferentes protocolos de ejercicio, que fueron una asociación de ejercicios de movilidad, fuerza, fuerza y aeróbicos. Esta asociación mostró mejoría en las diferentes condiciones clínicas de la IVC, y un impacto positivo en su calidad de vida. Conclusión: El ejercicio físico es beneficioso para los pacientes con IVC, pudiendo reducir los síntomas, aumentar la calidad de vida y prevenir la progresión de las enfermidades.
Palabras clave: Insuficiencia venosa; Ejercicio Físico; Calidad de vida; Enseñanza en salud.

1. Introduction

Chronic Venous insufficiency (CVI) is a common pathology in the medical practice, researchs show that the in general population, the prevalence of CVI in males is 1-17 % and on woman is 1-40%, it is considered the most frequent pathology on the western world (Tracci, 2018). It has great economic importance and social impact, resulting in the affected individuals' low productivity and poor quality of life (Henrique Gil França & Tavares, 2003) (Associação Entre a Classificação CEAP e Alterações No Eco-Doppler Venoso Dos Membros Inferiores, n.d.), (Como Avaliar o Impacto Da Doença Venosa Crónica Na Qualidade de Vida, n.d.).

There are several treatments to CVI it can be conservative, like compressed therapy and pharmacological therapy, or ca be invasive, like foam or liquid sclerotherapy, intravenous thermal or chemical ablation and surgical procedure. This treatments aim at improving its symptoms and prevent the CVI consequences and complications. (Santler & Goerge, 2017)

To increase the treatment options, physical exercise has been studied as a way to prevent the disease and to rehabilitate CVI patients, improving the public health assistance and reducing costs (Santler & Goerge, 2017); (César et al., n.d.); (Diagnóstico e Tratamento Da Doença Venosa Crônica, 2005); (da Silva & Nahas, 2008)

Specific exercises for patients with venous disorders show benefits to the muscle pump, with increase in strength and trophism; to the venous hemodynamics, with increased ejection fraction (EF), reduced residual volume fraction (RVF), venous filling index (VFI) and ambulatory venous pressure (AVP); thus reducing the disease symptoms. (Cristina et al., 2002) (Alberti et al., 2010)

The purpose of this systematic review was analyzed the effects of different types of physical exercise in the venous hemodynamics, muscular function and in the quality of life of individuals with CVI ulcerated and non-ulcerated.

2. Methodology

Criteria to include studies in this review. Were guided by the questioning if different types of exercise in individuals with CVI were capable to improve their muscular and the venous function and impact in their quality of life. This systematic review flowed the steps of Preferred Reporting Items for Systematic Reviews and Meta-Analysis - PRISMA guideline (Selçuk, 2019)

Research strategy

The articles surveyed were found in the data bases: Pubmed (MEDLINE), LILACS, PEDRO, SCOPUS, CINAHLS

and Cochrane between November 2019 and March 2020. The following descriptors were used (Insufficiency venous OR Venous Insufficiencies OR Chronic Venous Insufficiencies OR Venous Insufficiency)) AND (exercises physical OR exercise therapies OR training exercises OR activity physical OR rehabilitation exercises OR Physical Activity OR Therapy)) AND (Clinical Study OR Clinical Trial OR Controlled Clinical Trial OR Randomized Controlled Trial OR Equivalence Trial OR Pragmatic Clinical Trial OR Non-Randomized Controlled Trial OR Trial Nonrandomized Clinical), except for the search on the PEDro data base, when only 'insufficiency venous' was used.

The papers were selected by two independently reviewers through the reading of title first, of those selected the abstract was read, and of those selected was read the full text, to analyze whether they met the eligibility criteria. In case of disagreement between the rewires a third person helped to solve.

Eligibility criteria

Randomized and non-randomized clinical studies, in which physical exercise was the main treatment for patients diagnosed with chronic venous insufficiency (CVI), were included. No restrictions were set for idiom or year of publication. Studies where CVI patients presented ulcers or not, were over 18 years old, regardless of sex and ethnicity were included, considering the CVI classifications given by the authors according to the CEAP (Clinical, Etiology, Anatomy, Pathophysiology) classification.

Interventions with supervised or non-supervised physical exercise programs, which addressed muscle strength and stretch, articular mobility and aerobic exercises as treatment techniques and that compared the intervention to a control group or even the same group prior and post-intervention were also included. Other studies included were those comparing physical exercise and other types of intervention, such as the use of compression socks, or the combination of interventions within the same group with, for example, wearing compression socks and doing physical exercise regardless of the intervention time.

Control cases, literature reviews, letters to the editor, and systematic reviews were excluded. Papers that did not present physical exercise in any of the intervention groups with CVI patients, only presenting other interventions such as surgery, sclerotherapy, balneotherapy, kinesio tape among other techniques and treatment methods were also excluded from this review.

Evaluation of the methodological quality

Two independent people evaluated the methodological quality of the randomized clinical tests using the PEDro scale, which considers studies that received a score 6 to 10 as presenting high methodological quality, 4 to 5 moderate methodological quality and 0 to 3 low methodological quality. The non-randomized clinical tests were not evaluated regarding their methodological quality. A third reviewer checked the scores to prevent disagreements in this phase.

Data collection

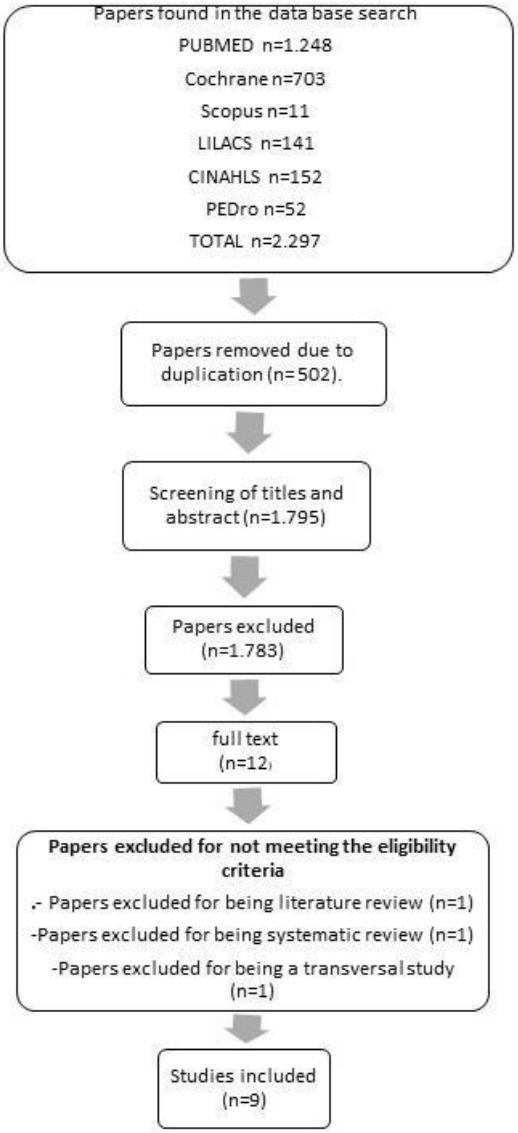
Two reviewers collected primary and secondary outcomes, methodology used, types of intervention and characteristics of the population investigated from the paper following the data extraction Cochrane model. The third reviewer checked this phase clarifying some doubts that appeared while the studies were selected.

The outcome analyzed were: the triceps surae muscle strength was analyzed using an isokinetic dynamometer, measuring the torque peak for 60 rpm and 120 rpm; Full ankle movement amplitude or separated into dorsiflexion and plantar flexion using a universal goniometer; Calf or ankle circumference through manual perimetry or using some equipment; Water displacement volumetry or other techniques; Venous hemodynamics (Ejection fraction, venous capacity, venous refilling total time and half time) using Doppler ultrasound or air plethysmography; Ulcer size variation, ulcer recurrence, time of cure of active ulcers. Quality of life was also analyzed in different scales, which were specific for venous pathologies or not.

3. Results

The bibliographic research identified 2,297 papers. Nine papers met the eligibility criteria and were included in this review, from those, six were randomized clinical trials and 3 were non-randomized clinical trials. Figure 1.

Figure 1 - Flowchart based on PRISMA statement.



Source: Authors.

The study characteristics qualitative are shown in Table 1.

Table 1: Characteristics of the studies included in the systematic review.

Author, date	Location	Study Design	Methodological Evaluation PEDro	Follow-up Period	Sample size/ MMII	Sample characteristics - CEAP	Intervention/ Comparison	Measurement methods	Results
Ercan et al., 2018	Turkey	Non randomized	No score	12 weeks	27 patients/ 49 MMII	Patients classified as C3 and C4 by the CEAP	Physical exercise and pneumatic compression	Torque peak for 60rpm and 120rpm. Life quality	Increased torque peak 60rpm (53%) and 120 rpm (36%)
Hartmann, Drews, Kayser, 1997	Germany	Randomized	3/10	24 weeks	24 patients/ 48 MMII	Patients with chronic venous insufficiency	Compression therapy and physical exercise and thermostasis/ No intervention	Venous capacity ml/100ml tissues, refilling time	Reduced venous capacity (16.3%). Increase in refilling time half (44.8%) and total (51%)
Klonizakis et al., 2017	United Kingdom	Randomized	7/10	12 months	39 patients	Patients classified as C6 by the CEAP	Compression therapy and physical exercise/ Compression Therapy/	Ulcer: Size, recurrence and cure and healing time. Ankle movement amplitude. Life quality	Increase in total movement (7%), in dorsiflexion (7.8%), plantar flexion (6%). 80% ulcers cured. Ulcer mean size varied from 2.6 cm to 0 cm
Kravtsov et al., 2016	Russia	Non- randomized	No score	60 days	22 patients	Patients classified as C3 and C4 by the CEAP	Physical exercise and massage	Ankle circumference. Life quality	Ankle circumference reduction (8,3%)
Meyer, Chacon, Lima, 2006	Brazil	Randomized	2/10	Around 3 weeks	8 patients	Patients classified as C1 and C2 by the CEAP	Pressotherapy (pneumatic compression)/lymphatic drainage/ Pressotherapy (pneumatic compression) and Lymphatic drainage/kinesiotherapy	Calf perimetry	Reduction only in the pressotherapy group 2.9%, only in the lymphatic drainage group 0.82%, lymphatic drainage and pressotherapy group (0.33%).
Mutlak, Aslam, Standfield, 2018	England	Randomized	4/10	3 months	80 patients	Patients classified as C6 by the CEAP	Compression therapy/ Compression therapy and physical exercise/ physical exercise	Ulcer size	Compression therapy group kept the mean. In the physical exercise group, 5% reduction. The group with both interventions, reduced (70%).
Padberg et al., 2004	United States	Randomized	5/10	6 months	28 patients	Patients classified as C4; C5 and C6 by the CEAP	Compression therapy and physical exercise / Compression therapy	Strength: Torque peak for 60rpm and 120rpm. Life quality	Increase for 60rpm (37%) and 120rpm (36%).
Quilici et al., 2009	Brazil	Non- randomized	No score	2 days	24 patients/ 28 MMII	Patients classified as C3; C4 and C5 by the CEAP	Trendelenburg and physical exercise	Water displacement volumetry. Ankle movement amplitude	3.41% edema reduction
Silva et al., 2010	Brazil	Randomized	6/10	16 weeks	22 patients	Patients classified as C1; C2 and C3 by the CEAP	Physical exercise/ No intervention	Venous diameter, 1 test RM	No variation was seen in the venous diameter

Source: Authors.

Sample characteristics

The participants had been diagnosed with chronic venous insufficiency, were all over 18 years old, most female and the sample sizes ranged from 8 to 80 patients. All participants were classified according to the CEAP from C1 to C6. The papers that measured ankle-brachial index (ABI) had an index over 0.7. (Klonizakis et al., 2018); (Mutlak et al., 2018); (Padberg et al., 2004). The duration of the studies varied from a two-day intervention to one year.

Two papers (Klonizakis et al., 2018); (Padberg et al., 2004) described the comorbidities presented such as hypertension and diabetes. One of the studies (Klonizakis et al., 2018) also described the type of medication used.

Intervention

A total of 162 chronic venous insufficiency patients (Klonizakis et al., 2018); (Padberg et al., 2004); (Quilici et al., 2009); (G. C. C. da Silva et al., 2010); (Ercan et al., 2018); (Kravtsov et al., 2016)) carried out muscle strengthening exercises. A hundred and sixty-one participants (Mutlak et al., 2018); (Ercan et al., 2018); (Kravtsov et al., 2016); (Meyer et al., 2006); (Hartmann et al., 1997) did articular mobility exercises. Three studies, totalling 94 patients (Klonizakis et al., 2018); (Padberg et al., 2004) (Ercan et al., 2018) worked with stretching and muscle flexibility exercises and included aerobic exercises in the intervention. A hundred and sixteen participants of the studies (Klonizakis et al., 2018); (Padberg et al., 2004) (Ercan et al., 2018); (Kravtsov et al., 2016) carried out more than one type of exercises in the intervention as shown in Table 2.

Table 2: Summary of the interventions carried out in the studies included in the systematic review.

Author, date	Type of exercise	Frequency	Duration of the study	Supervision	Duration of the exercise	Intervention Group	Control Group	Evaluation and reevaluation
Ercan et al., 2018	Aerobic, strength, muscle stretch and articular mobility	3x week	12 weeks	On-site supervision	60 minutes exercise + 20 minutes in intermittent pneumatic compression (JOBST)	Physical exercise and pneumatic compression	Not applicable	Beginning and 12 weeks
Hartmann, Drews, Kayser, 1997	Articular mobility	2x week + every day	24 weeks	On-site - 2x week Off-site – every day	60 minutes under supervision and 15 minutes without supervision	Compression therapy, physical exercise and thermostasis	No intervention	Beginning and 24 weeks
Klonizakis et al., 2017	Aerobic, strength and muscle flexibility	3x week (12 weeks - 36 sessions) – After that, daily	60 days	On-site - 12 weeks Off-site - 12 weeks	Not reported	Compression therapy and physical exercise	Compression therapy	Beginning, 12 weeks, 6 months and 1 year
Kravtsov et al., 2016	Muscle strength and articular mobility	2x a day (morning and evening)	12 months	On site	Not reported	Physical exercise and massage	Not applicable	Beginning and 60 days
Meyer, Chacon, Lima, 2006	Articular mobility	3x week (10 sessions)	Around 3 weeks	On-site	20 to 40 minutes	Pressotherapy (pneumatic compression)/ Lymphatic drainage/ Pressotherapy (pneumatic compression) and Lymphatic drainage	Kinesiotherapy (physical exercise)	Perimetry (beginning and end of treatment) and doppler (beginning and end of the intervention)
Mutlak, Aslam, Standfield, 2018	Articular mobility	7x week – Every hour	3 months	On the phone	Not reported	Compression therapy/ Compression therapy and physical exercise / Physical exercise	Not applicable	Beginning 3 months
Padberg et al., 2004	Aerobic, strength and muscle stretch	2x week	6 Months	On-site - 3 months Off-site - 3 months	60 minutes	Compression therapy and physical exercise	Compression therapy	Beginning and 6 months
Quilici et al., 2009	Muscle strength	1x day for	2 days	On-site	Around 30 minutes	Trendelenburg and physical exercise	Not applicable	Beginning and end of each phase
Silva et al., 2010	Muscle strength	3X week	16 weeks	On-site	30 to 50 minutes	Physical exercise	Not applicable	Beginning and end

Source: Authors.

One study (n= 80) did not present follow-up of the interventions (Mutlak et al., 2018) and another (n= 24) reported supervision of one type of exercise used, but not of the other (Hartmann et al., 1997), other studies (n = 67) reported supervision up to a certain point of the intervention, 12th week and 3 months (11) (13The remaining studies (n= 103) reported supervision of all exercises(Quilici et al., 2009).(Ercan et al., 2018; Kravtsov et al., 2016; Meyer et al., 2006a; Quilici et al., 2009; da Silva et al., 2010)

Ninety-six CVI patients took part in the intervention 3 times a week (Ercan et al., 2018; Klonizakis et al., 2018; Meyer et al., 2006b; G. C. C. da Silva et al., 2010). Sixty-one patients had intervention sessions every day of the week (Klonizakis et al., 2018; Kravtsov et al., 2016; Mutlak et al., 2018). Fifty-two patients had intervention sessions twice a week (Padberg et al., 2004) (Hartmann et al., 1997)

Thirty-nine participants underwent four evaluations of the measurements investigated throughout the study, at the beginning, after 12 weeks, 6 months and 1 year (Klonizakis et al., 2018). Two hundred and thirty-five participants were evaluated at the beginning and at the end of the study.

Measurement Methods

Fifty-five patients (Ercan et al., 2018; Padberg et al., 2004) had the triceps surae muscle strength verified through the torque peak for 60 rpm and 120 rpm given by the isokinetic dynamometer and 22 patients (G. C. C. da Silva et al., 2010) were submitted to the 1 RM method to measure this muscle maximum strength.

The manual goniometer was used to measure ankle movement amplitude in 63 participants (Klonizakis et al., 2018; Quilici et al., 2009) with evaluation of the dorsiflexion and plantar flexion movements measured separately in 39 patients and the total arc of movement in 24.

Thirty patients (Kravtsov et al., 2016; Meyer et al., 2006a) had the circumference and volume of lower limbs analyzed through manual perimetry (Moura et al., 2010) and using the Leg-O-Meter device (n= 8). In 28 lower limbs (n= 24) (Quilici et al., 2009) the water displacement volumetry method was used to measure the edema.

Two studies (n=46) (G. C. C. da Silva et al., 2010; Hartmann et al., 1997) presented venous hemodynamics (venous capacity, refilling time and venous diameter, respectively) as primary outcome. The first study used plethysmography, while the second employed doppler to measure the data used in the research.

A hundred and nineteen patients with active venous ulcer (Klonizakis et al., 2018; Mutlak et al., 2018) were analyzed regarding aspects of the ulcer such as size, recurrence and cure and healing time. In 80 patients, a ruler was used for the measurements, however, the measurement method or technique used to measure the ulcer in 39 patients was not described.

Four studies (n= 116) analyzed life quality, as a primary outcome in 67 patients (Klonizakis et al., 2018; Padberg et al., 2004) and as a secondary outcome in 49 patients (Ercan et al., 2018; Kravtsov et al., 2016). Thirty-nine participants answered the EQ-5D utility score EQ-5D, Visual analog scale and Venous Insufficiency Epidemiological and Economic Study – Quality of Life/Symptom (VEINES Qol/Sym) questionnaires. The Aberdeen Varicose Veins Questionnaire (AVVQ) and Chronic Venous Insufficiency Questionnaire (CIVIQ), which are specific for CVI populations, were applied to 28 participants. Twenty-seven patients had their life quality evaluated through the EQ-5D Index and EQ-5D Visual analog scale and 22 patients through the Chronic Venous Insufficiency Questionnaire (CIVIQ).

4. Discussion

This review explores the types of protocol of exercises such as emphasis on intensity, frequency and time, verifying their effects on muscle strength, movement amplitude, lower limb circumference and venous hemodynamics (ejection fraction, venous capacity, venous refilling total and half time). Their effect on ulcer size, recurrence and healing time, and life quality are also evaluated with specific methods for CVI patients or for the general population. On the same theme, a systematic

review elaborated by Araujo et al. (Araujo et al., 2016) explored two papers, with methodological evidence low quality, in which one of them did not find differences between the group with physical exercises and the control group regarding life quality and movement amplitude, while the other presented improvement in the ejection fraction, half refilling time and total refilling time, suggesting the need for further studies on the theme. Another systematic review elaborated by found that there is an improvement in muscular strength, ankle range movement, but like this review, they found that the metrological quality, of the studies analyzed, is a limitation to stabilizing the impacts of the exercise in the treatment of CVI. (Silva et al., 2021)

Depending on the CEAP, the muscle pump quality might be more harmed (Back et al., 1995), CEAP 4, 5 and 6 are also proved to have worse life quality than the remaining ones (Moura et al., 2010). Variations regarding the venous pump function are also observed when comparing men and women, and women tend to show higher predisposition to CVI and different muscle structure (Alberti et al., 2010); (Beebe-Dimmer et al., 2005); (A et al., 2018). Age seems to be another factor predisposing patients to CVI, and the elderly tend to be more affected by the disease (Engelhorn et al., 2003)

While surveying the papers, we could notice that these factors were only described in the sample characterization, not being compared individually in the results, which characterized a methodological flaw.

When physical exercises act on muscle strength, there is a reduction in the disease progression and an improvement of the venous pump function, however, this does not influence the occurrence of the disease as found in the study by Alberti et al., 2010 (Alberti et al., 2010). There are several calf strength exercise programs, and many ways of evaluating, depending on the characteristics of the population under evaluation. Muscle torque is related to the number of repetitions and series, overload, sequence and interval between the series of exercises (Schoenfeld, 2010). This review showed a difference in the intensity and time of duration of the exercise programs in the papers that analyzed muscle strength and they also differed regarding the aspects evaluated, hampering the comparison of the efficacy of the interventions (G. C. C. da Silva et al., 2010; Ercan et al., 2018; Klonizakis et al., 2018; Padberg et al., 2004; Quilici et al., 2009)

After few days of intervention, it was already possible to notice improvements in the venous hemodynamics in individuals in the last stage of CVI, such as reported by Kan & Delis (Kan & Delis, 2001). The same result was observed by Qulici, et.al (Quilici et al., 2009), who applied the intervention for two consecutive days. However, only after the 3rd and 4th weeks of physical exercise it was possible to observe gains in the muscle strength according to Lima et al. (Cristina et al., 2002) and Signorile et al. (28). Two of the papers included in the review, Ercan, et.al (Ercan et al., 2018) and Padberg et.al (Padberg et al., 2004), reported that muscle strength increased during the 12 weeks and 6 months, respectively, of application of the physical exercise protocol. This review concluded that for the effects to be long lasting, the exercise programs acting on muscle strength must last at least 3 weeks and might be kept for up to 6 months.

The movement amplitude also interferes in the venous pump function. With the increase in the disease severity, the movement amplitude is seen to reduce (Miranda et al., n.d.) (Back et al., 1995). This interference occurs for two reasons: edema and active ulcers, which lead to the ankle ankylosis causing its stiffness (de Jesus Leal et al., 2016); (Timi et al., 2009), (Moloney et al., 2006). The results of this review pointed out that studies that worked on articular mobility presented reduction in the edema, ulcer size and increase in the movement amplitude (Ercan et al., 2018; Hartmann et al., 1997; Kravtsov et al., 2016; Meyer et al., 2006a) similar to those found in the studies by Tanaka et al. (Tanaka & Ravagnani, 1995). This suggests that regardless of the type of physical exercise to be associated with (stretching or muscle strength), the ankle articular mobility must be worked to avoid future complications regarding lack of movement amplitude.

Stretching interferes in the articular, muscle and venous functions of the calf and is relevant for the improvement of CVI patients' conditions (Bertoldi & Proença, 2008; de Jesus Leal et al., 2016). In this review, physical exercise protocols were seen to associate stretching to strength and mobility exercises, which resulted in an increase in both the muscle strength and the articular movement amplitude, along with reduction in the ulcer size, similar results were also found in the studies by

Lima et al. (Cristina et al., 2002) and Samora et al.(Samora et al., 2014). Taking that into consideration, the association of exercise protocols that also include stretching for a global improvement of the muscle and venous aspects as well as the disease symptoms seems to be highly relevant.

The intervention protocols also included aerobic exercises such as walking. One of the functions was to reduce the participants' BMI, since obesity is associated to increase in the intra-abdominal pressure, which reduces the venous return, worsening the CVI clinical conditions. Another function is the improvement in the movement amplitude and muscle strength (Cristina et al., 2002; de Jesus Leal et al., 2016; Kan & Delis, 2001; Samora et al., 2014). The studies surveyed in this review that applied this type of intervention resulted in BMI reduction (Klonizakis et al., 2018) and increase in the movement amplitude and muscle strength (Ercan et al., 2018; Padberg et al., 2004). Therefore, the inclusion of aerobic exercises in intervention protocols with the purpose of reducing BMI and improving other conditions presented by CVI patients is recommended.

The relation between physical exercises and improvement in life quality was observed by Samora et al., (Samora et al., 2014) and Lima et al. (Lima et al., 2002), who evaluated this variable with non-specific instruments for CVI populations and saw an increase in the scores investigated, similarly to the findings by Klonizakis, et.al., (Klonizakis et al., 2018) and Ercan, et al. (Ercan et al., 2018) all papers surveyed in this review. When life quality was analyzed with specific instruments such as by Klonizakis, et.al (Klonizakis et al., 2018)and Kravtsov, et. Al (Kravtsov et al., 2016) increase was also observed. The difference of evaluation methods and instruments used made it impossible to compare the results of those papers.

5. Conclusion

However, individuals with higher level of physical activity were observed to present lower frequency of venous diseases, and those who are already affected by the disease could experience benefits such as the improvement of the venous, muscle and articular function and better life quality. Furthermore, is important to have more studies with a higher methodological quality to established the impacts of exercise in the chronic venous insufficiency

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