REVIEW ARTICLE

# Physiotherapy intervention during pre and post-prosthetic fitting of lower limb amputees: a systematic review

Rafael Isac Vieira[1], Soraia Cristina Tonon da Luz[2], Kadine Priscila Bender dos Santos[3], Erádio Gonçalvez Junior[4], Paloma Vanessa Coelho Campos[5]

## ABSTRACT

Physical therapy interventions in amputee patient before and after the placement of a prosthesis are cited in a variety of physical therapy services, however, it is necessary to systematize evidence of rehabilitation protocols. **Objective:** The objective of this study was to add scientific evidence to guide the physical therapy practice in pre- and post-fitting of lower limb amputee. **Method:** We conducted a systematic review during the months of August to December 2014 in the databases Lilacs, Medline, Pedro, Pubmed, Scielo and Cochrane. Articles published from 2000 to the first half of 2014 were selected by key words in Portuguese, English and Spanish. **Results:** Six articles met the inclusion criteria, and only one was related to the pre-fitting stage highlighting the intervention: bandaging of the stump. The other interventions referred to the post-fitting stage as muscle force training, aerobic training, functional and gait. **Conclusion:** Few articles were found with scientific evidence related to major interventions pre and post prosthesis routinely used by the physiotherapist, which hinders the establishment of protocols and the reinforcement of the effectiveness of commonly described therapies.

**Keywords:** Amputation, Lower Extremity, Physical Therapy Modalities, Rehabilitation

[1] Fisioterapeuta.
[2] Professora, Departamento de Fisioterapia, Universidade do Estado de Santa Catarina – UDESC.
[3] Fisioterapeuta, Doutoranda, Universidade Federal de Santa Catarina - UFSC.
[4] Fisioterapeuta, Prefeitura Municipal de Florianópolis.
[5] Professora, Faculdade de Educação São Francisco - FAESF.

Mailing address:
Universidade do Estado de Santa Catarina - Laboratório de Biomecânica
Soraia Cristina Tonon da Luz
Rua Pascoal Simone, 354
CEP 88800-000.
Florianópolis - SC
E-mail: soraiaudesc@hotmail.com

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## INTRODUCTION

Lower limb amputation, combined with functional limitations, is the source of physical and social losses.[1] Rehabilitation of amputees must begin as early as possible, addressed to recovery of the activities of daily life (ADL). The lower limb amputee undergoes changes in blood circulation, metabolism, posture balance and gait, reduction in work capacity, and in tolerability of ADL, all of which demand specialized care so that physical rehabilitation is achieved.[2-4]

Pre-prosthesis physiotherapy for the lower limb amputee aims, primarily, to solve the swelling and the algesia, combined with the purpose to enhance the healing, to desensitize and exercise the residual limb so that it is suitable for receiving the prosthesis.[5]

Regarding the post-prosthesis physiotherapy, a long-term training and adaptation is needed and, commonly, it is carried out along hardships such as quality of life reduction due to discomfort caused by the prosthesis, what reduces independence for the ADLs.[6]

The prosthetic rehabilitation efficiency of adults with lower limb amputation depends on the amputation level, as well as the anatomical and functional condition of the residual limb and he remaining joints, the prosthesis quality, and the cardiorespiratory function of the patient. In this context, the motor rehabilitation is essential to keep the whole body at work, leading to a more efficient treatment.[7,8]

This systematic review is justified by the relevance of this issue, its relationship with the social repercussion and the need of an effective integral rehabilitation for these patients, based on interventions with high scientific evidence level. We consider that the physiotherapist has an important role in the physical rehabilitation of patients who underwent amputation, and, in the daily practice, we notice a wide demand for resources and physiotherapeutic interventions that are commonly described. Therefore, our goal was to find which physiotherapeutic interventions that are considered consensus for pre and post-prosthetic phases of lower limbs amputees that have scientific evidence. A deeper understanding of this issue may lead to improvements in rehabilitation practices for amputees.

## OBJECTIVE

The objective of this study is to compile scientific evidences to guide the physiotherapeutic practices during pre and post-prosthesis rehabilitation phases of lower limb amputees.

## METHODS

The systematic review was carried out as recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), aiming to increase the methodological standards and the quality of this study.

From August to December of 2014, the searches were carried out in LILACS, MEDLINE, PEDro, PubMed, SciELO and Cochrane, all of which health sciences related databank. The relevant articles were those published between 2000 and the first semester of 2014 that used the following descriptors, in Portuguese, English, and Spanish: *Physiotherapy, Amputation, Amputee, Lower Limb, Rehabilitation,* and the Boolean operators AND and OR. The Figure 1 shows the information on the different phases of the systematic review.

The articles were evaluated according to the Physiotherapy Evidence Database Scale (PEDro). In this review, we included scientific articles that reported randomized clinical trial that enrolled patients above 18 years of age, with lower limb amputation, with evidences on pre and post-prosthesis physiotherapeutic techniques. The chart 1, emphasizes the methodological steps along this study.

After the data compilation, it was possible to compare the articles regarding similarities and differences on their methods, patients, interventions and outcome. Inseparably, the external validity of the articles was evaluated on the knowledge of the clinical condition, and the internal validity was verified by the knowledge of the scientific method.

The qualitative evaluation of the articles (chart 2) was performed according to: 1- The eligibility criteria; 2- The distribution of the patients into random groups; 3- The sealed allocation of patients; 4- The groups were similar per the most important prognosis indicators; 5- All subjects were blinded to the treatment; 6- All the therapists were blind to the treatment; 7- All the raters were blind; 8- Measurements of at least one key evaluation were taken in more than 85% of the subjects initially distributed along the groups; 9- All the subjects analyzed received the active or control treatment as the allocation, or the analysis of a key outcome was performed as intention to treat (ITT); 10- The results of the intergroups statistical comparisons of at least one key outcome is described; 11- The study presented precision measures and variability measures for at least one key outcome.

## RESULTS

Concerning the amputation level of the six selected articles, most of them were transfemoral, followed by transtibial and Symes.

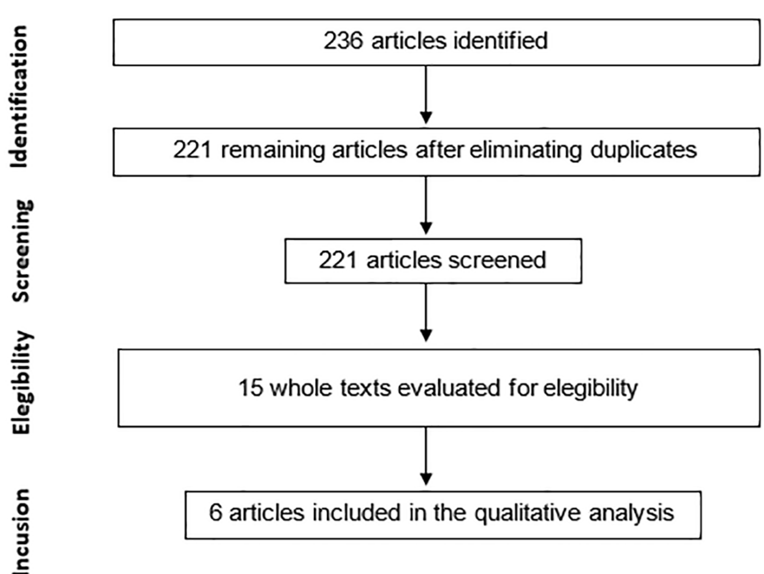


**Figura 1.** Fluxo de informação com as diferentes fases desta revisão sistemática.

**Chart 1.** Diagram with articles distribution according to descriptors and the inclusion and exclusion criteria

| |
|---|
| The articles were identified, had their title screened under the following descriptors, in English, Portuguese, and Spanish: amputees, lower limbs, physiotherapy and rehabilitation. |
| After reading the abstract, the excluded articles under the following criteria: different methodological designs; different populations; techniques that are non-applicable for physiotherapy; other languages; different publication year; articles that did not fit the objectives of this study. |
| The identified and screened articles were tried on consensus among the evaluators, and the full article was read. |
| The articles that met the methodological criteria of this study were included. |

**Chart 2.** Qualitative evaluation of the articles according to Physiotherapy Evidence Database Scale (PEDro)

| Itens | Wong et al.[9] | Buckley et al.[10] | Rau et al.[11] | Mayer et al.[12] | Nolan[2] | Pauley et al.[6] |
|---|---|---|---|---|---|---|
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | No | No | Yes | No | Yes | No |
| 3 | No | No | No | No | No | No |
| 4 | Yes | No | Yes | Yes | Yes | No |
| 5 | No | No | No | No | No | No |
| 6 | No | No | No | No | No | Yes |
| 7 | Yes | No | No | No | No | No |
| 8 | Yes | Yes | Yes | Yes | No | Yes |
| 9 | Yes | Yes | Yes | No | Yes | Yes |
| 10 | Yes | No | Yes | Yes | Yes | Yes |
| 11 | Yes | Yes | Yes | Yes | Yes | Yes |
| Total | 7 | 4 | 7 | 5 | 6 | 6 |

The chart 3 presents the data on the only randomized clinical trial included in this review. It reports the pre-prosthesis (stump bandaging), organized as author/year, manuscript title, interventions, patients included (n), and objective of the study.

The chart 4 presents the data concerning the studies performed during post-prosthesis phase, under the same eligibility criteria. The physiotherapeutic interventions were carried out during the post-prosthesis phase and the number of articles that reported the following interventions were: muscle strengthening (3); functional training (2); gait training (2); and aerobic exercises (1).

In the qualitative evaluation, we realized patients were not randomly allocated into the treatment groups. All included articles selected their patients in a blind fashion.[6,9,10,12] However, in only one article the therapists performed the therapy in a blind fashion, what agrees with what PEDro emphasizes, that few studies blind their therapists (2%). In only one article[9] all the evaluators that rated at least one key outcome were blinded to it, whereas in only one study[2] the results refer to more then 85% of the enrolled patients. Scientifically and methodologically, these findings show the quality of the evidence, once it assures the treatment and control groups are comparable.

Only one study[10] failed to describe the intergroup statistical comparisons of at least one key outcome.

## DISCUSSION

### Pre-prosthesis Physiotherapeutic Interventions

There was only one article that reported pre-prosthesis rehabilitation of lower limb amputees, and its intervention was related to a semi-rigid bandage of the residual limb.[9] It is important to emphasize that in the literature, as well as in the daily practice, other interventions are reported concerning this phase: use of transcutaneous electrical nerve stimulation (TENS) on the residual limb for post-amputation pain management, lower and upper limb strengthening exercises, deep transverse friction massage at the stump scar for prevention and/or for removing adherences, stump desensitization techniques for improving local sensitivity, contracture preventions with stretching and positioning recommendations, gait trainings with crutches, unipodal balance training, and wheelchair training when orthostatism is not possible.

One of the first pre-prosthesis interventions refers to the pain evaluation at the residual limb. Regarding the prophylaxis of pain, no article met the eligibility criteria. Finsen et al.[13] emphasize that, after studying the effects of TENS at the residual limb scar as well as for the early and late prophylaxis of post-surgery pain of amputation and disarticulation of knee, transtibial and Syme amputation, their results have shown that TENS has beneficial for healing, pain and re-amputation cases, which were lower in patients who undertook TENS.

We are aware that the rehabilitation of the patients who undergo amputation surgeries demands, still at the hospital, focus on the residual limb edema and pain management, both considered the very fist step. It is understood that the edema management is particularly important for patients with peripheral cardiovascular diseases, once its association with inefficient blood circulation may lead to wound healing delays, jeopardizing the rehabilitation.[9]

There are, however, several bandaging techniques, all of which with the objective to prevent and/or reduce the edema, to provide an adequate fit to the stump, and to allow early adaptation to the prosthesis.[5]

A traditional method to bandage the residual limb is to use elastic stripes, however this technique must be well applied, or it may loosen with the movement and friction, resulting in excessive pressure, and, therefore, pressure ulcers and stump deformation.[9]

The semi-rigid bandaging with plaster immediately after surgery is in the literature and, even though it is not commonly applied in Brazilian hospitals, it has advantages in reducing the post-surgery edema, in preventing knee flexors contracture, and in modeling and protecting the amputee limb.[9] In this study,[9] one group received semi-rigid bandages and the other group received elastic stripes, and it was evidenced that the group that received semi-rigid bandaging yielded better results during rehabilitation, received their prosthesis and were discharged before the patients who received the elastic stripes. This study also emphasized that in the group with the elastic bandaging, many groups were discharged with the use of wheelchair.

The changes in the stump volume along the rehabilitation process occur in several moments: early after surgery; after the beginning of prosthesis usage, during which the stump undergoes fluctuations and have its perimeter

**Chart 3.** Characteristics of the pre-prosthesis study

| Author/ Year | Manuscript title | Intervention | n | Objective |
|---|---|---|---|---|
| Wong et al.[9] 2000 | Unna and Elastic Postoperative Dressings: Comparison of their effects on function of adults with Amputation and Vascular Disease | Semi-rigid elastic bandaging for the residual limb | 21 | Compare the functional results of swelling control of the residual limb combined with the use of a semi-rigid elastic bandaging |

**Chart 4.** Characteristics of the pre-prosthesis studies

| Author/Year | Manuscript title | Intervention | n | Objective |
|---|---|---|---|---|
| Buckley et al.[10] 2002 | Oxygen consumption during ambulation: comparison of using a prosthesis fitted with and without a tele-torsion device | Gait in treadmill | 6 | Verify the energy expenditure and the subjective classification of comfort while walking with the prosthesis of transtibial amputees |
| Rau et al.[11] 2007 | Short-term effect of physiotherapy rehabilitation on functional performance of lower limb amputees | Strengthening exercises, weight rolling, coordination, gait training, and obstacle management | 58 | Evaluate the efficacy of a short-term physiotherapy program compared to a regular program, that consisted of walking, specially |
| Mayer et al.[12] 2011 | Adaptation to altered balance conditions in unilateral amputees due to atherosclerosis: a randomized controlled study | Conventional physiotherapy and gait training. Balance evaluation | 31 | Evaluate the postural balance adaptation by stabilometry of two transtibial amputee groups under physiotherapy: adapted prosthesis users and prosthesis users under adaptation |
| Nolan[2] 2012 | A training program to improve hip strength in persons with lower limb amputation | Cycle ergometer, coordination training, balance training, flexors and extensors strengthening | 16 | Investigate the effect of a strengthening training of the hip for 10 weeks of lower limbs amputee |
| Pauley et al.[6] 2014 | A single blind cross-over trial of hip abductor strength training to improve timed up e go performance in patients with unilateral transfemoral amputation | Hip abductor machine | 17 | Evaluate the strengthening training of hip abductors of unilateral transfemoral amputees |

reduced. In this phase, it is important that the patient use a temporary fit for his/her residual limb, and then the definitive fit is made, resulting in an adapted prosthesis with comfort and functionality. The changes in body mass of the amputees after receiving their prosthesis also compromise the fluctuation of the stump volume.

Despite scientific evidences of a study related to different use of bandages for edema reduction, the physiotherapeutic therapies in the pre-prosthesis phase go beyond these interventions. The stump desensitization techniques for reducing local hypo or hyper sensitivity increases the chances of prosthetization.[14] Brandão et al.[14] believed that the use of slow circular movements in the stump with varied materials, from smooth to rough texture may satisfactory desensitize the stump. The deep transverse friction massage (Cyriax) at the stump scarf is featured to be able to release several degrees of adherence. Other resources such as therapeutic massage with superficial sliding, squeezing, compression and rolling also have scientific evidence.[14]

Stretching exercises of anterior and posterior lower limbs muscles allow the development of elasticity of the muscle fibers, consequently diminishing articular overload. Moreover, the postural reeducation also allows the posture alignment, supporting more coordinate and more functional movements.[15,16]

It is also suggested that fatigue resistant rehabilitation exercises must be included for both the stump and the contralateral limb, as to grant better general functionality of the patient. Isometric and isotonic strengthening exercises for adduction, abduction, flexion and extension of hips and knees must be prioritized, because they yield adequate muscular balance for the development of the movements with the prosthesis aiming to avoid inadequate gait standard with high energy expenditure.[17]

The motor capacities of amputees do not depend only on the level of amputation and in the anatomical and functional condition of the residual limb, but largely in the dynamic capacities of the cardiorespiratory systems. Thus, aerobic exercises with wheelchair and exercises with loads for the upper limbs are adequate tools for social inclusion of these patients, allowing their regress to life in community as persons without disabilities.[7]

## Post-prosthesis Physiotherapeutic Interventions

Most included articles reported evidences related to this phase, with great emphasis on the gait rehabilitation with the prosthesis. As the lower limb loss is associated to atrophy of 40% to 60% of the sectioned muscles and of up to 30% of the hip stabilizer muscles, the strength loss is not directly related to the amputation surgery, but to the lack of muscle usage. Moreover, lower limb weaknesses is predictor of falls, therefore the preservation of muscle strength of the lower limbs is crucial for amputees with prosthesis.[6]

As acknowledged, the reduced activities of these muscle groups of the amputees also predicts the type of gait known as post-prosthesis Trendelenburg gait, that is commonly observed among lower limb amputees.[5]

A randomized clinical trial[6] studied transfemoral amputees; six right side amputees and eleven left side amputees. This study had one blinded evaluator and the patients were randomized into a control group (n=8) and an experimental group (n=9) for whom a training was given. Both groups were using the prosthesis for six months prior to inclusion. Their objectives were to investigate a training program for hip abductors strengthening to improve their functional performance in the Timed Up & Go (TUG), as well as to measure the hip abductors strength in the two-minute walking test. The researchers also included a balance test to investigate the changes in the perception of postural control of the patients. The training was performed in a cycle ergometer for a warming up period followed by an abductor machine (Cybex Medway®). For these groups, the American College of Sports Medicine (ACSM) suggest the high intensity strength training as a safe and efficient strategy to improve general function. The strengthening was carried out in the abductor machine in the fashion of 3 series of 10 maximum repetitions (10MR), for 2 or 3 days per week, for 8 weeks. The analyses have shown significant improvements such as an 11% increase in the hip abductors strength, what led to increase in speed of the TUG of up to 17%. Moreover, regarding the two-minute walking test, its distance increased 7%. As for the balance test, there was a 12% improvement in the postural control.

Aiming to evaluate the efficacy of an intensive physiotherapy program with conventional gait training, Rau et al.[11] included 58 lower limb amputees (transfemoral, transtibial, knee and ankle disarticulation). The experimental group undertook intensive training with seven exercises that lasted approximately one hour.

Lower limb strengthening exercises with the aid of boxes and stairs, and weight rolling in the following position were included: knees extended, hip and trunk flexed, and arms stretched so that hands could touch the ground. Other activities were included, such as coordination tasks, gait training on irregular surface and obstacle management, and functional training such as water transportation. The control group undertook supervised conventional gait training on flat surface.

In this study, the researchers chose the two-minute walking test, the Physiological Cost Index (PCI), the TUG, as well as 5 questions from the Functional Measure for Amputees Questionnaire (FMA). Prior to the teste, which lasted 30 minutes per patient, a prosthesis expert assessed whether the alignment, adjustments, and function of the prosthesis were suitable.

We understand that this verification was fundamental, for the amputees' rehabilitation success demand that the prosthesis fulfill the needs of comfort and function, and that it should be assembled, adjusted and aligned according to the type of stump and the profile of the patient so that there is maximum function recovery and minimum gait deviation. Compared to the control group, the experimental group had greater benefits in two out of five evaluations: the two-minute walking test and in PCI.

Concerning the main outcome, the walking test, the results of pre and post intervention have shown significant differences towards the experimental group (p=0.024), as the distance in the experimental group was significantly larger than in the control group (20.12m and 8.92m, respectively). The speed also significantly increased in the experimental group (p=0.016).

The PCI resulted in significant differences as well (p=0.02), with a significant improvement of 0.77 beats/m in the experimental group and 0.39 beats/m in the control group. It evidences that this physiotherapeutic intervention yields improvements in gait speed and in benefits for cardiac conditioning of lower limbs amputees, therefore, it is efficient to rehabilitation.

This study[2] investigated the effects of a hip strengthening training for 10 weeks with an isokinetic dynamometer. Seven transtibial amputees, eight transfemoral amputees, and one bilateral (transtibial and transfemoral) amputees were included in the study. The participants were allocated in two groups: the experimental group received a ten-week training program and the control group received a regular physiotherapy program that included gait training, aerobic training and swimming, as specified by the author. All participants undertook strength test, oxygen intake, and, gait test before and after the training.

The flexors and extensors concentric strength of the hip was evaluated with the isokinetic dynamometer that assessed the bilateral strength of the residual limb without the prosthesis and with the necessary adaptations. The oxygen intake was monitored by an Oxycon-Pro. The participants also wore a Polar cardiac monitor.

The walking test was performed in treadmill, and the speed was gradually increased according the patient feedback. All participants were able to conclude this test.

For the gait analysis, the ProReflex movement analysis system and the AMTI force platform was used to collet the data before and after the 10-week, two times a week training program. Firstly, there was a warmup period of 20 in a cycle ergometer, then the coordination and balance exercises were performed for approximately 5-10 minutes. The tasks were: balance on an instable surface, walk past obstacles, sit and stand, walk over a narrow stripe placing one foot on front of the other, walk through a series of small hoops on a flat surface, pacing one foot in each hoop up until the end of the circuit.

The strengthening exercises were divided in slow and fast movements of hips flexion and extension. For the execution of hip flexion movements, the patients stood up and flexed their hips, lifting their thighs parallel to the floor, then returned to the initial position. For the extension movements, the patients used a support to freely extend and lift their legs as high as possible, without rotating the pelvis.

The patients were instructed to choose the weight they could bear and to repeat the movements 10 times, therefore the series were 2x10 repetitions for slow movements and 2x15 fast movements. From the third week on, the tasks were increased to 3x10 and 2x15, for slow and fast movements respectively. All patients were able to perform with weights of 8-9kg up until the end of the ten-week program. After every session, a non-specified stretching exercise was carried out.

The experimental group had their body mass significantly reduced, whereas the results for resistance were statistically similar. Also, the strength variables for both limbs, the residual and the contralateral, increased. In the control group, there was no significant strength increase and the patient with bilateral amputation also had his strength variables increased.

The oxygen intake was significantly reduced in the experimental group, but not in the control group. The patients in the experimental group also reported their gait got easier after the training, specially in the balance phase. This study evidenced that in the clinical practice, the hip strengthening of transfemoral and transtibial amputees help the regain of a suitable level of functionality.

This study also emphases that patients with transtibial amputation with significant preserved muscle resistance of the thigh have good gait capacities, as well as the muscle weakness of the hip muscle of the residual limb negatively affects the gait of patients with transfemoral amputation. Their findings also present that the strength of the hip extensors is a relevant predictor for a better performance in the 6-minute walking test.[2]

The energy expenditure for locomotion is greater in lower limbs amputees when compared to healthy individuals. It is related to the reduction in comfort of the prosthesis fit and to the propulsion in the final support phase, what requires compensation of the healthy limb and an asymmetric gait.[18]

Buckley et al.,[10] aiming to assess the energy expenditure and the subjective classification of comfort when walking with prosthesis of transtibial amputees, enrolled six unilateral transtibial amputees that were able to execute moderate intensity exercises for at least 30 minutes, five days a week. All patients managed to complete the whole protocol somehow easily.

Five patients reported they did not have any issues with their prosthesis, whereas one of them reported his prosthesis was loose, what was resolved by wearing an extra sock in the stump. All patients wore a liner with suspension, a sock for the stump or a polyethylene foam. The models with foot varied, such as dynamic foot with multiflex ankle, Otto Bock C-walk foot, and SACH foot.

This protocol was divided in pre-test and test. As the patients arrived in the lab, they were instructed to rest for ten minutes. Then, they had their resting cardiac frequency monitored with the help of a Polar, being followed by a familiarization test by walking with their prosthesis coupled with a shock absorbing system called Pylon TT, on a monitored ELG 70 treadmill. These patients were also monitored by a nozzle and a nose clip for data collection. Another group of patients, the control group, performed the same task, without the Pylon TT.

The average (normal) walking speed was defined according to the comfort of each patient, then they would walk in their normal speed, 130%, and 160% of their normal speed interposed with a rest period in between each speed level. The treadmill was set at an inclination of 0° and at each speed level lasted 6 minutes. The exhaled air was collected by the nozzle which was connected to a Douglas bag. The comfort was measured during the test in a five-level scale, from 1 (very comfortable) to 5 (very uncomfortable). The gas analyses were carried out by a Servomex 1400. The volume per minute and the temperature of the remaining exhaled gases in the Douglas bag were determined by a Harvard gas analyzer and an Edale thermometer.

The average speed was 3.2 +/- 0,3 km/h, and at 130% and 160% of the normal speed, it was 4.2 +/- 0.4 km/h and 5.1 +/-0.6 km/h, respectively. The $O_2$ volume increased according to the speed levels with 5.4% lower significance with the Pylon TT device and 9.1% without the Pylon TT device, what shows lower energy expenditure when this device is used. Regarding comfort, four patients in the Pylon TT group reported they felt it was more comfortable to use it, whereas two other patients reported they felt no difference.

The postural stability was significantly greater in the non-affected side when compared to the side with the prosthesis, what demanded a balance training for the amputee that did not receive the prosthesis.[10,12]

By analyzing the synergism differences of the hip joint during gait of unilateral lower limb amputees and healthy individuals, the authors concluded that the weight load at the lower limbs were not laterally equal in the amputees, as it is observed that there is lower weight load in the prosthesis side.[19]

As the amputation jeopardizes balance, Mayer et al.[12] investigated the postural stability and balance of unilateral transtibial amputees divided in two groups: patients soon after receiving their prosthesis and patients already active with their prosthesis. They were assessed for 20 minutes by stabilometry, which consisted of a force platform, amplifiers, computer, and specialized software.

Along the training and the evaluations, they used two balance adaptation strategies: with eyes open, the amputees undertook dynamic excursions that consisted of placing their whole weight over one leg combined with flexing the contralateral hip and knee. The dynamic excursions for the amputees yielded worse performance due to pain and fatigue over the residual limb, and patients who had recently received their prosthesis had 28% larger postural oscillation over the healthy limb at the static unipodal position.

Regardless if the patient had recently received their prosthesis or if the patient was already actively using the prosthesis, it is relevant to emphasize that static or dynamic balance training so that these patients can become more confident on their prosthesis, what yields a more effective gait and, therefore, a better quality of life and the return to the activities of daily living.

## CONCLUSION

The final objective of the physiotherapeutic of the lower limb amputees is to allow them to proceed with their activities of daily living, their leisure and work activities with a functional, safe and comfortable gait with their prosthesis. Considering that the physiotherapeutic approach must include pre and post-prosthesis interventions based on scientific evidence regarding its benefits, efficacy, and efficiency towards the patients, we found scarce scientific evidences, what hinders the rehabilitation planning. We evidenced the efficacy of the early bandaging of the residual limb, and the positive effects post-prosthesis interventions, such as muscle strengthening, aerobic training, and gait and functional training.

Other randomized clinical trials with elevated methodological rigor must be motivated towards larger sample sizes and different interventions of the routine physiotherapeutic interventions of lower limb amputees.

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