

Dor fantasma em amputados de membro inferior como fator preditivo de aquisição de marcha com prótese

Phantom pain in lower limb amputees as a predictive factor for the acquisition of gait with prosthesis use

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RESUMO

A reabilitação do paciente amputado obedece a algumas fases: avaliação geral do paciente, reabilitação pré-protética e reabilitação pós-protética. Para que todas essas etapas sejam alcançadas e cumpridas com sucesso, é indispensável que o paciente apresente um bom estado geral, sem alterações que possam comprometer a reabilitação. A presença de sinais e/ou sintomas patológicos impedem uma boa evolução do processo. A presença de dor fantasma persistente prejudica a reabilitação do paciente amputado, em especial, o processo de aquisição de marcha com a prótese. Esta é a hipótese sugerida nesta revisão de literatura, que apresenta como objetivo relacionar a presença de dor fantasma com a aquisição de marcha com prótese em pacientes amputados de membro inferior. Após analisar os 11 estudos selecionados, concluiu-se que a dor fantasma tende a dificultar a marcha com prótese, mas que, quando a protetização é alcançada de maneira eficiente, pode influenciar no alívio da mesma.

PALAVRAS-CHAVE

Dor fantasma, amputados, marcha.

ABSTRACT

The amputees' rehabilitation follows distinct phases: the patient's general assessment, preparation for the prosthetic use and prosthetic fitting. For all these phases to be successful, it is essential for the patient to be in good health, with no alterations that would impair the rehabilitation. Pathological signs and/or symptoms that persist over time are an impediment for a good rehabilitation evolution. The presence of persistent phantom pain impairs the amputee's rehabilitation, especially the gait acquisition with the prosthesis fitting. This is the hypothesis suggested in this literary review and its objective is to show the relationship between phantom pain and gait improvement with prosthesis use in lower limb amputees. After analyzing 11 studies selected from MEDLINE, LILACS and other electronic sources, we concluded that phantom pain tends to complicate the prosthesis gait improvement; however, if the prosthesis fitting is successful, it can minimize the painful phantom sensations.

KEYWORDS

Phantom pain, amputees, gait.

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Introduction

The rehabilitational approach of an amputated patient must be instituted early, aiming more than the prosthesis adaptation, i.e., a functional recovery, providing professional re-adaptation conditions and social reintegration^{1,2}. The amputee frequently demands much from social services and specialized personnel in hospitals and the community. In addition to the social adaptation, the rehabilitation process involves the patient's independent gait training and the use of gait aids³.

The presence of alterations in the general conditions of the amputees can prevent the optimal progress of each one of the rehabilitation phases. Frequently, lower limb amputees develop phantom sensation and pain after the amputation⁴, with impaired evolution of the therapeutic programs, especially the amputee's prosthesis adaptation.

The term *phantom limb* was described for the first time by Mitchell in 1866, characterizing it as a ghost replica of the lost limb⁴. The perception of non-painful sensations in the amputated part of the limb is defined as phantom sensation⁵. It is such a real sensation that the amputee can try to stand up, walk or lean on the lost extremity⁶.

The phantom pain is described as the presence of a painful sensation in the absent part of the amputated limb⁶. Jensen⁷ describes that not only the phantom pain but also the phantom sensation typically appear within a few days after the amputation, and tend to decrease in frequency and duration with time.

Finally, the amputee can report amputation stump pain, which is the localized pain in the residual part of the amputated limb⁶.

During the rehabilitation period, some complications can affect the amputee and delay, particularly, this last phase of the program. In 1986, Helm and cols.⁸ demonstrated that the presence of pain contributes to an unfavorable prognosis. When analyzing the functional status of patients after the amputation of lower limbs, they observed that it was necessary to stimulate the use of adequate prosthesis and control pain in order to achieve ideal functional levels.

Houghton and cols.⁹ studied the natural history of phantom pain and its association with rehabilitation and suggested that phantom pain must be considered as a determinant factor in the process of the amputee's prosthetization.

A more recent study analyzed the use of prosthesis and the level of satisfaction of prosthesis users who were victims of traumatic amputations of the lower limbs⁹. Although the majority of this population uses prosthesis, a large part (57%) is not satisfied with the supplied comfort. This fact may be related to the persistence

of phantom pain, reported by 25% of the patients.

This review is justified, thus, based on the data supplied by literature that suggest the evidence of a negative association between the presence of phantom pain and the development of functional skills in amputated patients. Regarding lower limb amputees, their functional activity climax is to acquire independent gait. Hence, we chose to verify the influence of phantom pain on the process of gait acquisition in lower limb amputees.

Material and Methods

Procedures

The study was conducted based on the MEDLINE, LILACS, PUBMED and COCHRANE databases, from which all articles containing the key words pain, phantom, amputation, amputee and gait, in the Portuguese, Spanish and English languages, were selected. There were no restrictions regarding the publication period. The material was selected and analyzed carefully, through critical reading, aiming at finding any mention to the hypothesis suggested in this study.

Using combinations of the key words, we found 7 articles from LILACS, 258 articles from MEDLINE, 1605 articles from PUBMED and 12 literature reviews from COCHRANE. The abstracts of these articles were analyzed and 05 articles from LILACS, 48 articles from MEDLINE, 33 articles from PUBMED and 04 articles from COCHRANE were selected for reading and analysis in full. Additionally, 18 articles were obtained from non-electronic search and were also analyzed.

This bibliographic research included the studies that demonstrated any relation to phantom pain and the use of prosthesis for deambulation in lower limb amputees. Based on the inclusion criteria described in this study, 05 articles from MEDLINE, 03 articles from LILACS and 03 articles obtained from non-electronic search were selected to be incorporated in this review. However, it is important to clarify that none of the articles found or selected was directly related to phantom pain as an impediment for the acquisition of gait in lower limb amputees, but that this association can be drawn as a suggestion offered by the articles included in this review. The articles excluded from the review were those related to amputations without the process of prosthetization, or other issues about amputees that did not fit the association mentioned in the inclusion process.

Resultados

Chart 1

Literature studies showing authors' names, year and country of publication, source of research, type of study and evaluation method of the phantom pain.

Authors	Year of publication	Country of origin	Source	Type of study
Helm, Engel, Holm, Kristiansen e Rosendahl ⁽⁸⁾	1986	Denmark	Non-electronic	Cohort
Houghton, Nicholls, Houghton, Saadah, McColl ⁽⁹⁾	1994	UK	MEDLINE	Transversal
Krane e Heller ⁽¹⁰⁾	1995	USA	MEDLINE	Transversal
Wartan, Hamann, Wedley e McColl ⁽¹¹⁾	1997	England	MEDLINE	Transversal
Ehde, Czerniecki, Smith, Campbell, Edwards, Jensen e Robinson ⁽⁴⁾	2000	USA	MEDLINE	Transversal
Dillingham, Pezzin, MacKenzie e Burgess ⁽¹²⁾	2001	USA	Non-electronic	Transversal
Hagberg e Branemark ⁽¹³⁾	2001	Sweden	LILACS	Transversal
Murray e Fox ⁽¹⁴⁾	2002	UK	LILACS	Transversal
Whyte e Carroll ⁽¹⁵⁾	2002	Scotland	Non-electronic	Transversal
Borsje, Bosmans, Van der Schans, Geertzen e Dijkstra ⁽¹⁶⁾	2004	Holland	MEDLINE	Transversal
Whyte e Carroll ⁽¹⁷⁾	2004	UK	LILACS	Transversal

Chart 3.

Relative numbers (%) of the incidence of phantom pain (PP), phantom sensation and stump pain per study.

Authors / Year of publication	Phantom Pain (PP)	Phantom sensation	Stump pain	PP at VAS	PP at MPQ	PP Assessment
Helm, Engel, Holm, Kristiansen e Rosendahl, 1986 ⁽⁸⁾	71.3%	*	43.9%			*
Houghton, Nicholls e Houghton, 1994 ⁽⁹⁾	78%	82%	*	1		VAS
Krane e Heller, 1995 ⁽¹⁰⁾	83.3%	100%	*			Varni-Thompson Pediatric Pain Questionnaire
Wartan, Hamann, Wedley e McColl, 1997 ⁽¹¹⁾	55%	66.8%	56%	5.6 (0-10)		VAS
Ehde, Czerniecki, Smith, Campbell, Edwards, Jensen e Robinson, 2000 ⁽⁴⁾	72%	79%	74,00%	5.1 (0-10)		VASSF-MPQ
Dillingham, Pezzin, MacKenzie e Burgess, 2001 ⁽¹²⁾	72%	*	35.9%			*
Hagberg e Branemark, 2001 ⁽¹³⁾	65%	*	51%			Swedish SF-36 Health Survey
Murray e Fox, 2002 ⁽¹⁴⁾	100%	*	*		11.5 (0-20)	MPQ
Whyte e Carroll, 2002 ⁽¹⁵⁾	100%	*	*			MPQ
Borsje, Bosmans, Van der Schans, Geertzen e Dijkstra, 2004 ⁽¹⁶⁾	62.5%	*	*			GQPAA/GQPLA
Whyte e Carroll, 2004 ⁽¹⁷⁾	100%	*	*			MPQ

* Not described in study. MPQ = McGill Pain Questionnaire. VAS = Visual Analogue Scale. GQPAA = Groningen Questionnaire Problems after Arm Amputation. GQPLA = The Groningen Questionnaire Problems after Leg Amputation

Chart 4.

Literature studies showing authors' names, year of publication, time of amputation (in years) and association with phantom pain (PP).

Authors / Year of publication	TTime of amputation	Association with PP
Helm, Engel, Holm, Kristiansen e Rosendahl, 1986 ⁽⁸⁾	*	*
Houghton, Nicholls e Houghton, 1994 ⁽⁹⁾	5 to 20	PP decreased in intensity and frequency with time
Krane e Heller, 1995 ⁽¹⁰⁾	Up to 10	PP decreased in intensity and frequency with time
Wartan, Hamann, Wedley e McColl, 1997 ⁽¹¹⁾	30 to 50	53% of the sample experienced decrease or resolution of PP
Ehde, Czerniecki, Smith, Campbell, Edwards, Jensen e Robinson, 2000 ⁽⁴⁾	14.2	*
Dillingham, Pezzin, MacKenzie e Burgess, 2001 ⁽¹²⁾	7.5	*
Hagberg e Branemark, 2001 ⁽¹³⁾	22	*
Murray e Fox, 2002 ⁽¹⁴⁾	*	*
Whyte e Carroll, 2002 ⁽¹⁵⁾	13.15	*
Borsje, Bosmans, Van der Schans, Geertzen e Dijkstra, 2004 ⁽¹⁶⁾	*	Patients with PP have more recent amputations than those without
Whyte e Carroll, 2004 ⁽¹⁷⁾	*	*

* Not described in the study

Chart 2
Literature studies showing authors' names, year of publication, number of patients studied, amputated limb, cause of amputation, mean age and gender.

Authors/Year of publication	Number of patients	Amputated limb	Cause of amputation	Mean age (yrs)	Gender
Helm, Engel, Holm, Kristiansen e Rosendahl, 1986 ⁽⁸⁾	107	LL	*	75	57,9% ♂ / 42,1% ♀
Houghton, Nicholls e Houghton, 1994 ⁽⁹⁾	176	LL	55.6% trauma 44.4% vascular	69,9	*
Krane e Heller, 1995 ⁽¹⁰⁾	24	LL	46% trauma or infection 41.5% cancer 12.5% congenital	5 a 19	*
Wartan, Hamann, Wedley e McColl, 1997 ⁽¹¹⁾	26	89.5% LL / 10.5% UL	*	73	100% ♂
Ehde, Czerniecki, Smith, Campbell, Edwards, Jensen e Robinson, 2000 ⁽⁴⁾	255	LL	53% trauma 20% vascular 23% infection 21% gangrene 13% diabetes 2% congenital 5% tumor 19% others	55,1	81% ♂ / 19% ♀
Dillingham, Pezzin, MacKenzie e Burgess, 2001 ⁽¹²⁾	146	LL	100% trauma	*	87% ♂ / 13% ♀
Hagberg e Branemark, 2001 ⁽¹³⁾	97	LL	55% trauma 35% cancer 10% others	48	62% ♂ / 38% ♀
Murray e Fox, 2002 ⁽¹⁴⁾	44	LL	36.3% trauma 36.6% cancer 6.8% congenital 4.5% vascular 2.2% diabetes	42	54,5% ♂ / 38,6% ♀
Whyte e Carroll, 2002 ⁽¹⁵⁾	315	90%LL / 10% UL	47% trauma 12% vascular 21% disease 12% cancer 8% congenital	43,79	74% ♂ / 26% ♀
Borsje, Bosmans, Van der Schans, Geertzen e Dijkstra, 2004 ⁽¹⁶⁾	536	81.5% LL / 18.5% UL	38.4% trauma 23.7% vascular 16.8% diabetes 9,1% cancer 6.9% congenital 4.3% others	61,5	69,4% ♂ / 28,5% ♀
Whyte e Carroll, 2004 ⁽¹⁷⁾	315	90% LL / 10% UL	47% trauma 12% vascular 21% disease 12% cancer 8% congenital	43,79	74% ♂ / 26% ♀

*Not described in the study; LL: Lower limb; UL: Upper limb.

Chart 5.
Literature studies showing authors' names, year of publication, number of patients referring use of prosthesis (in relative numbers) and association with phantom pain (PP).

Authors / Year of publication	Prosthesis use	Association with PP
Helm, Engel, Holm, Kristiansen e Rosendahl, 1986 ⁽⁸⁾	73% used prosthesis	Absence of PP contributed to higher functional capacity and social independence.
Houghton, Nicholls e Houghton, 1994 ⁽⁹⁾	Most of the sample used prosthesis routinely and for several years	In general, rehabilitation and PP correlated negatively; however, only 22% of the patients perceived such association.
Krane e Heller, 1995 ⁽¹⁰⁾	*	
Wartan, Hamann, Wedley e McColl, 1997 ⁽¹¹⁾	80% used prosthesis	It was not significant; only 8% had aggravated PP due to prosthesis use.
Ehde, Czerniecki, Smith, Campbell, Edwards, Jensen e Robinson, 2000 ⁽⁴⁾	83% used prosthesis	75% of people with PP are included in the two lowest categories of disability related to pain.
Dillingham, Pezzin, MacKenzie e Burgess, 2001 ⁽¹²⁾	94.8% used prosthesis	Amputees with PP reported a lower level of satisfaction with prosthesis use in relation to the other amputees.
Hagberg e Branemark, 2001 ⁽¹³⁾	82% used prosthesis daily	PP interrupted prosthesis use in 9 of 80 patients.
Murray e Fox, 2002 ⁽¹⁴⁾	100% used prosthesis	PP makes prosthesis use difficult as it decreases quality of life in different ways between the genders.
Whyte e Carroll, 2002 ⁽¹⁵⁾	100% used prosthesis	The longer the number of daily hours with the prosthesis, the lower were the levels of PP.
Borsje, Bosmans, Van der Schans, Geertzen e Dijkstra, 2004 ⁽¹⁶⁾	*	
Whyte e Carroll, 2004 ⁽¹⁷⁾	62% used prosthesis during the whole day	38% did not wear prosthesis due to PP.

(**) does not reflect the reality, as prosthesis use was the adopted intervention.

Discussion

When analyzing the methodology used to organize the sample assessment, it can be observed that most of the studies used vali-

dated questionnaires. Only three articles^{9,11,13} cited questionnaires developed by the authors and which, therefore, were not validated instruments recognized by the world's literature. However, regarding phantom pain, it seems that in all the studies the patients

were well informed and could answer coherently to the questions regarding the subject, which contributed for the reliable reporting of phantom pain, stump pain and phantom sensation incidence.

As the study sought to correlate phantom pain and the process of gait acquisition in amputees, the search for the articles were directed towards those that dealt with lower limb amputees. As it can be observed in Chart 2, most of the studies supply data on such population. However, some studies comprehend not only lower limb but also upper limb amputees.

The mixed articles regarding the amputated extremity make important references to the pain and/or use of prosthesis in lower limb amputees, and were therefore included in this review.

Chart 2 shows also the causes of amputation in the samples from each study. The large incidence of traumatic amputations can be perceived. Such incidence might be related to the relatively young population and the large number of males of which the studies consist. The association between the cause of the amputation and the amputee's gender is quite marked in the study by Dillinghan¹²; their sample consists exclusively of amputees due to traumatic causes and 87% of them are males.

The incidence of phantom pain in each study can be observed in Chart 3. Although the range of 55% to 100% of phantom pain incidence can be considered a large one, the important thing is that this incidence is always above 50%, i.e., more than 50% of the sample of each study reported phantom pain. It is also noteworthy that in 8 of the 11 studies presented, phantom pain was experienced by more than 70% of the population. In three of them^{14,15,17}, 100% of the sample reported phantom pain; however, these studies must not be considered when one intends to analyze the incidence of phantom pain in the general population, as the presence of phantom pain was considered an inclusion criterion for them, i.e., the participants were not chosen randomly regarding the presence of phantom pain.

When one analyzes the prevalence of phantom pain, it must be observed which points of view were considered to evaluate the frequency. Some studies evaluate the presence of phantom pain by asking the participants to choose between "yes" or "no" to express whether they feel phantom pain or not, respectively. However, a question remains: amputees that experience phantom pain once or twice a year must be classified equally to those who always present phantom pain¹⁶?

Four studies showed an interesting association between the incidence of phantom pain and phantom sensation. It was observed that whenever the phantom sensation was reported, it was more significant than the phantom pain. Regarding the stump pain, there was no constant in the association of the latter with phantom pain, as shown in Chart 3.

One-third of the studies used the Visual Analog Scale (VAS) to measure phantom pain. This scale consists of a horizontal line, divided in 10 equal-sized spaces, scored from left to right from 0 to 10. The individual being assessed must be advised that 0 (zero) means absence of pain and 10 (ten) means the worst pain ever felt, and that the pain augments as number order increases⁴.

The use of the same assessment resource by several studies

makes the analysis of the results easier, as one can be sure that the data presented were collected in exactly the same manner. Thus, of the four studies that showed the phantom pain score at the VAS, 3 presented very close scores, which represents a moderate-intensity pain and is in agreement with other published studies^{7,18,19}.

A moderate-intensity pain was also observed in a study that evaluated this issue through the McGill Pain Questionnaire (MPQ), i.e., within a range of 0 (zero) to 20 (twenty), the average intensity of phantom pain was 11.5. This shows that even when different assessment tools are used, the data obtained could be correlated and what is more important, that such data were in agreement. The MPQ was used by 25% of the studies and must be recognized for its importance.

Chart 4 allows the correlation of phantom pain with the time of amputation. This subject has been quite often reported^{9,11,20}; however, it is not completely clarified. Some studies show that phantom pain is more common in the immediate postoperative period^{9,10,11,16}. According to this review, of the 5 articles that referred to the subject, four reported that phantom pain tends to decrease in intensity and/or frequency with time.

Chart 5 shows the influence of phantom pain on the prosthesis use. As the process of prosthetization usually finalizes the amputee's rehabilitation, it is of crucial importance to try to clarify any factor that can impair this treatment phase. When trying to confirm that phantom pain would be an obstacle to the increment of gait with prosthesis for the amputee, the only studies found were those that suggested this statement is true, but no specific study on this matter was found.

However, the simple fact of observing that studies with different objectives suggest the existence of such question is a predictive factor of the need for further studies that can clarify the issue.

Some findings are then discussed, which suggest the negative influence of phantom pain on prosthesis use. Two studies show that phantom pain was responsible for the interruption of the prosthesis use. In one case¹⁷, 38% of the sample reported not using prosthesis due to phantom pain, whereas another study¹³ showed that only 11% in a sample of 80 amputees reported the same problem.

To complement these data, a study¹⁴ carried out in the UK, which proposed the analysis of the association between prosthesis and body image satisfaction in lower limb amputees, as well as its variations between the genders, concluded that phantom pain interferes with the amputees' prosthetization process, as it decreases the quality of life of these individuals. According to the authors, the patients that better face the loss of a limb suffer less phantom pain.

Regarding quality of life, Hagberg and Branemark¹³ published a study, in which they state that the traumatic transfemoral amputation has an evident impact on quality of life, and thus, important problems arise during the prosthesis use training.

Some studies, although they did not correlate phantom pain directly to the use of prosthesis, showed that phantom pain negatively influence the amputees' functionality. The physical debilitation after the amputation is permanent and can be overwhelming: in many cases the amputation generates a massive dependence of the

patient in relation to other people²¹.

Considering that the samples in these studies consisted of lower limb amputees, it is obvious that these individuals' functionality impairment is related to deambulation, which directs it to prosthetization. For most of the amputees, daily mobility is impaired after the amputation. When Helm and cols.⁸ investigated the functional capacity and the social dependence of lower limb amputees, they observed that the absence of phantom pain contributes favorably to the functional prognosis after the amputation. These authors considered that an adequate prosthetic training and enough analgesic prescription are necessary for the amputee to achieve good functional levels.

Houghton and cols.⁹ associated phantom pain with rehabilitation. According to their study, although only 22% of a sample of 176 lower limb amputees considered phantom pain a hindrance to rehabilitation, when the data collected were analyzed globally, phantom pain was found to be a negative influence factor in the rehabilitation of the amputee on a prosthetic limb.

Regarding satisfaction with the prosthesis, a study¹² concluded that amputees with phantom pain reported a lower level of satisfaction with the use of prosthesis when compared to the other amputees. Even patients with stump pain were more adapted to the use of prosthesis than patients with phantom pain; this fact is yet to be clarified, according to the authors of the study.

Some studies have demonstrated alterations in phantom pain caused by the use of prosthesis. In one case¹¹, although the use of prosthesis did not present a significant difference between the amputees that reported phantom pain and those who did not, 8% of the sample experienced worsening of the phantom pain after the prosthesis. On the other hand, a study reported improvement in the phantom pain after the use of prosthesis and the authors concluded that, the longer the hours spent with the prosthesis daily, the lower were the levels of phantom pain¹⁵. Although it was carried out exclusively with upper limb amputees, the study by Weiss and cols.²² defends the theory of the increment of stump use, according to which, the increased use of the residual limb after the amputation can reduce or eliminate phantom pain.

After this review on the probable interference of phantom pain on gait acquisition in lower limb amputees, we observed that several authors have used validated tools to assess the pain symptomatology in amputees, and thus, it can be affirmed that phantom pain is a common and prominent symptom in this population. Additionally, it interferes with functionality, and consequently, with the amputee's quality of life²³.

Conclusion

After the analysis of the selected articles, it can be observed that phantom pain tends to impair the prosthetization process in amputees. However, when this process occurs, it can be a determinant factor in the decrease of phantom pain.

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