

THE RELATIONSHIP BETWEEN DYSPHAGIA AND CLINICAL TYPES IN PARKINSON'S DISEASE

Relação entre disfagia e tipos clínicos na doença de Parkinson

Douglas Monteiro⁽¹⁾, Maria das Graças Wanderley de Sales Coriolano⁽²⁾,
Luciana Rodrigues Belo⁽³⁾, Otávio Gomes Lins⁽⁴⁾

ABSTRACT

Dysphagia is a common symptom in Parkinson's disease, but the cause and mechanism are still unclear. It is known that the manifestations may be derived from dysphagia motor symptoms characteristic of Parkinson's disease. Thus, the study aims to investigate whether the literature indicates the relationship between dysphagia and clinical types (predominant symptoms) in Parkinson's disease and levodopa influences swallowing in these patients. The search was performed using databases: portal Bireme (Medline, Lilacs, IBECs, Scielo, Cochrane Library, among other banks portal) and the Pubmed website. There was no restriction regarding the year of publication and language. The descriptors used were: Parkinson's disease and Parkinson's disease or Swallow or deglutition or swallowing and dysphagia and Levodopa. 29 papers were found, of which only two were included in the eligibility criteria. But the articles selected are not a clear relationship between dysphagia and the classic symptoms of Parkinson's disease, but the results show that point to an improvement in swallowing after levodopa in some patients or in patients with dyskinesia. More studies are needed that can clarify this issue, helping to guide therapeutic interventions more targeted and effective.

KEYWORDS: Parkinson Disease; Parkinsonian Disorders; Deglutition; Deglutition Disorders; Levodopa

■ INTRODUCTION

Among the pathologies that affect the Central Nervous System (CNS), Parkinson's Disease (PD) stands out because it is one of the most frequent neurological diseases^{1,2} affecting 0.3% of the general population³. It is estimated that in 2020 more than 40 million people may have motor disorders due to this pathology⁴.

PD is a chronic and degenerative condition of the CNS which results from the neural death of

dopaminergic cells of the compact portion of the substantia nigra of the midbrain, causing reduction of dopamine in the nigrostriatal pathway^{5,6}.

It is characterized principally by motor disorders such as tremors while in rest, rigidity, deficits in equilibrium and marching, aside from slowness and reduction in movement amplitude, with marked difficulty to initiate them⁷⁻⁹. However, it can also be responsible for other associated systemic manifestations and for autonomous functions. Its symptoms normally manifest at around 60 years of age, and men are generally more affected than women¹¹.

Dysphagia, which is the difficulty of swallowing food¹², is a common symptom of PD¹³ and it can develop at any moment in the evolution of the disease. Some authors have suggested that subclinical dysphagia can be one of the initial symptoms of PD¹⁴, while others state that the complaints of swallowing disorders are reported in more advanced stages¹⁵.

⁽¹⁾ Federal University of Pernambuco - *Universidade Federal de Pernambuco*, UFPE, Recife, PE, Brazil.

⁽²⁾ Department of Anatomy of the Federal University of Pernambuco - *Universidade Federal de Pernambuco*, UFPE, Recife, PE, Brazil.

⁽³⁾ Federal University of Pernambuco - *Universidade Federal de Pernambuco*, UFPE, Recife, PE, Brazil.

⁽⁴⁾ Federal University of Pernambuco - *Universidade Federal de Pernambuco*, UFPE, Recife, PE, Brazil.

Conflict of interest: non-existent

It is widely accepted that there are various causes not directly related to PD that contribute to dysphagia¹⁶. Principally due to muscular rigidity and bradykinesia, dysphagia manifestations can come from a delay in swallowing reflexes and the reduced mobility of the oropharyngeal structures – with possible premature loss of food and its accumulation in the oral part of the pharynx, epiglottic vallecula and piriform, which favors pulmonary aspiration¹².

Pneumonia caused by aspiration is one of the main causes of morbidity and mortality of individuals with Parkinson's disease, indicating that aspiration during feeding should represent an important concern¹⁴. From a clinical perspective, it is necessary to identify the people with PD that may have dysphagia, since these patients could be at risk of aspiration pneumonia, malnutrition and psychosocial morbidity¹⁷.

The disease reduces life expectancy, which could be partly restored by treatment with Levodopa and other drugs¹⁸. The use of exogenous dopamine allows the PD patient to normalize part of his/her motor function, improving some of the symptoms¹⁹. However, even if Levodopa is the most effective and used medication, it could present early or late collateral effects, such as fluctuations, 'wearing-off', mental disorders, dyskinesia, and the 'on-off' phenomenon²⁰. Moreover, due to the chronic and degenerative character of PD, harmful effects from daily routine are inevitable²¹.

Therefore, the objective of this study is to carry out a systematic revision of the relationship between dysphasia and the clinical types (predominant symptom) in Parkinson's disease, addressing secondarily the influence of Levodopa in the swallowing of patients.

■ METHODS

This systemic revision of the literature was carried out by three researchers (DM, LRB and MGWSC), who independently and blindly carried

out the search for data. A fourth researcher (OGL) carried out the revision and was consulted in case of doubts.

According to the conducting question of this revision: What is the relationship between dysphagia and the clinical types of Parkinson's Disease? The primary expected outcome was that dysphagia may be related to a specific clinical type of PD (trembler or rigid-akinetic patients). The secondary outcome refers to the effect of Levodopa on the swallowing of these patients.

The search was carried out between February and June of 2012, using the databases: site of Bireme (Medline, Lilacs, Ibecs, Scielo, Biblioteca Cochrane, among other banks of this site) and site Pubmed. There was no restriction regarding year of publication or language. The key worlds used were Parkinson or Parkinsonism and **Deglutition**, or Swallowing, or Swallow and Dysphagia and **Levodopa**. The key words in bold were selected according to lists DeSC and MeSH. The rest are key worlds that were used to widen the search.

The references of the articles that were found through the key words were analyzed to verify relevant studies for the revision which were omitted in the electronic search.

Experimental studies with adult human beings of both genders – with clinical diagnosis of idiopathic Parkinson and who used medication for the motor symptoms of the pathology – were included. Qualitative studies, letters to the editor, case reports and literature revisions were excluded.

The quality of the selected articles was evaluated through the Jadad scale (Table 1), which presents 5 questions, where each 'Yes' is equivalent to 1.0 point (variation: 0.0 to 5.0 points). Articles which reached 2.0 or less points were classified as low quality. The punctuation of the Jadad scale does not constitute an eligibility criterion.

Table 1 – Jadad Scale

Studies considered in the revision	Fuh et al, 1997		Monte et al, 2005	
1. Was the study described as being randomized?	YES (X)	NO ()	YES ()	NO (X)
2. Was the randomization adequate?	YES ()	NO (X)	YES ()	NO (X)
3. Was the study described as being double-blind?	YES (X)	NO ()	YES (X)	NO ()
4. Was the masking adequate?	YES ()	NO (X)	YES (X)	NO ()
5. Were the losses and exclusions described?	YES ()	NO (X)	YES ()	NO (X)
TOTAL	2		2	

Search and selection of articles:

In the search and selection of articles the following key words were considered: Parkinson or Parkinsonism and **Deglutition**, or Swallowing, or Swallow and Dysphagia and **Levodopa**. The references of the 7 articles evaluated were consulted, however, no new inclusions occurred. The search and selection of the articles are shown in Figure 1.

General characteristics of the articles included in the revision:

The articles considered for the revision after careful analysis of the evaluated selection were: Fuh et al.²² and Monte et al.²³. The general characteristics of the articles included in the revision are shown in Table 2.

Quality of the selected articles:

There are different scales that help evaluate the studies, such as the list of Delphi, PEDro, OTSeeker, criteria of Maastricht, Jadad scale, among others²⁴.

The Jadad scale (Table 1) constitutes a valid instrument; simple, short and reliable in the evaluation of an article's quality. It presents three questions related to randomization, masking and description of losses and exclusions. These items are presented as questions provoking answers with 'yes' or 'no'. The variation of points is of 0 to 5, considering 2 or less 'yes' answers as poor quality²⁵.

The studies of Fuh et al.²² and Monte et al.²³ obtained just 2 'yes' answers.

The compilation of the characteristics of the articles in relation to the outcomes is represented in Table 3.

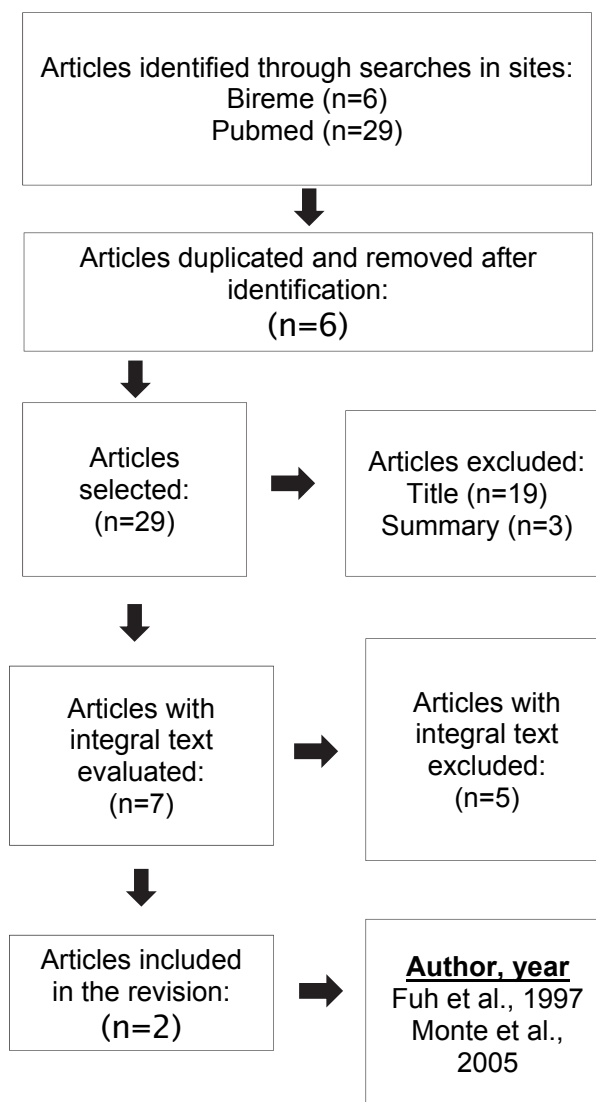


Figure 1 – Flowchart of the search and selection of articles for the systematic revision.

Table 2 – General characteristics of the articles included in the revision.

Author, year	Design of the study	Sample PD/ Gender	Sample CG/ Gender	HY	Age PD (me- dium)	Age CG (me- dium)	Time (disease)	Medication/ Dose	Clinical Type
Fuh et al., 1997	NI	19 (♂=15; ♀=4)	X	1-4	68.4±10.4 years	X	3.2±2.1 years	standard- ized: 200mg/day of Levodopa + 50 mg/day of benzerazide	Tremor and non-tremor patients
Monte et al., 2005	NI	27(♂=17; ♀=10)	7 (♂=4; ♀=3)	excluded stage 5	61.9±9.6 years	56.5 ± 7.8 years	7.7±4 years	not stan- dardized: 768.7±404.0 mg/day of Levodopa (medium)	Dyskinetic and non-Dyskinetic patients

NI: not informed; CG: Control Group; DP: Parkinson's Disease.

Table 3 – Characteristics of the selected articles regarding the outcomes

AUTHOR, YEAR	INSTRUMENTS OF EVALUATION	VARIABLES ANALYZED	RESULTS
FUH et al., 1997	VF of swallowing to evaluate the objective dysphagia. Scale similar to UPDRS to evaluate subjective dysphagia.	<ul style="list-style-type: none"> - Time of oral transit; - Movement of the tongue; -Velopharyngeal competence; - Initiation of reflex swallowing; - Elevation of the larynx, epiglottic motility; - Closing of the larynx; - Residue in vallecula and pyriform sinuses; - Aspiration before, during and after swallowing; 	<ul style="list-style-type: none"> - There was no significant difference in the levels of residue found in trembling and non-trembling patients. - After Levodopa 50% of patients presented improvement in swallowing and another 50% did not present any changes. - From the three patients that presented aspiration, two improved after Levodopa therapy.
MONTE et al., 2005	VF of swallowing. UPDRS (items II and III)	<ul style="list-style-type: none"> - Time of oral transit; - Time of pharyngeal transit; - Efficiency of oropharyngeal swallowing for liquids; - Residue in vallecula and pyriform sinuses; - Aspiration of liquid and solid foods. 	<ul style="list-style-type: none"> - There was no significant difference between the dysphagia in dyskinetic and non-dyskinetic patients, nor in the control group. - Dyskinetic patients presented greater efficiency in swallowing. This difference was close to being significant (p=0.06), however, this difference disappears when doses of L-dopa are considered. - Only non-dyskinetic patients had pharyngeal retention of liquid and solids. - Dyskinetic patients presented longer time of disease, as well as higher doses of L-dopa and time of use of medication. - Patients who use higher doses of L-dopa tend to have lower time of oral transit and have more swallowing efficiency.

LITERATURE REVIEW

In the present search merely two studies (Fuh et al. and Monte et al.)^{22,23} were found which showed a relationship between the predominant symptom of PD and dysphagia, and no studies were found dealing with the prevalence of dysphagia related to the classical symptoms of PD.

Although dysphagia is frequent in PD, the cause and the mechanism of dysphagia in PD remain obscure as the physiopathology is little known^{26,27}.

The articles of Fuh et al.²² and Monte et al.²³ presented similar study designs, they evaluated swallowing in PD patients of both genders, with similar average age (60-70). They used video-fluoroscopy (VF) as the evaluation instrument for swallowing, separated the sample in two groups – considering different clinical types – and carried out the exams in the ‘on’ and ‘off’ conditions with the objective of comparing the differences between the groups and their response to therapy using Levodopa.

The quality of the articles was also the same since both obtained the same punctuation according to the Jahad Scale.

The objective of Fuh et al.²² was to determine the standard of swallowing dysfunctions in subjects with PD and the relationship between the symptoms presented by the patients and the reaction to treatment with Levodopa.

In the study of author²² the patients included were in stages 1 to 4 in the scale of Hoehn and Yahr (HY), the dose of the medication was standardized for all patients and a similar scale to Unified Parkinson’s Disease Rating Scale (UPDRS) was used to evaluate subjective dysphagia. The proofs of the VF used were: 3, 5, 7cc of thin barium, 3, 5cc of pasty barium and 1cc of biscuit. The difference between the swallowing of trembling and non-trembling patients was also verified, however, the study did not describe the main symptom present in the non-trembling group.

Regarding the results, the author only described that there was no significant difference between the levels of residue found in the vallecula and pyriform sinuses of both groups.

The same study²² showed that 31.57% of patients presented subjective dysphagia, evaluated by a similar scale to that of UPDRS, and that 63.2% presented objective dysphagia diagnosed through the VF exam.

When considering the reaction to treatment using Levodopa, Fuh et al.²² states that 50% of patients diagnosed with objective dysphagia presented improvement after Levodopa, while the other 50% did not present any change.

From the group of patients which presented improvement, one showed improvement in the oral phase and worsening in the dysphagia. Aside from this, from three patients who had presented aspiration, two improved after using Levodopa.

The author²² reports that in his study the number of patients in the most advanced stages of PD was small (only 1 subject in stage 4, and 1 in stage 3), and that there was a high rate of asymptomatic dysphagia in the initial stages of the disease.

This same study²² indicates that there was a reduction of bradykinesia and tongue rigidity after treatment with Levodopa, which probably brought improvements in swallowing in half the patients with oropharyngeal abnormalities. The study also suggests that the dopaminergic mechanism can also have an important role in the oropharyngeal control of swallowing.

The main objective of Monte et al.²³ was to show the difference between the swallowing of patients with and without dyskinesia. The study reports the use of the HY scale, but informs only that it did not include the subjects in stage 5 of the disease. Items II and III of the UPDRS, evaluated the influence of PD on daily life activities of patients and motor abilities respectively.

To verify the reaction of a patient’s swallowing to Levodopa, the author did not standardize the doses, stating that the patients took the medication in a frequency that varied from a minimum of 3 times a day and a maximum of every 2 or 3 hours. The VF proofs for swallowing were: 10ml of thin barium, one toast of bread (8cm³) with barium, and water between swallowing for cleaning.

Monte et al.²³ observed in his study that 55% of patients presented dysphagia. There was no significant difference between the dysphagia found in patients with or without dyskinesia. However, patients without dyskinesia presented less efficient swallowing than the control group and a tendency to less efficiency when compared with dyskinesia patients.

The author²³ suggests that the tendency for greater efficiency in the oropharyngeal swallowing of dyskinesic patients found in his study can be explained by the effects of Levodopa, since these patients used higher doses of medication for a longer period of time.

Monte et al.²³ still suggest that other neurotransmission systems, aside from the dopaminergic, one could be involved in the swallowing disorders of PD, corroborating with other authors²⁷⁻²⁹.

Hunter et al.²⁹ state that swallowing is regulated by a hierarchical system of structures that extends from the frontal and limbic cortex until the basal ganglia, the hypothalamus, pons and medulla. It is

important, however, to highlight that more studies are needed to better outline the systems involved for therapeutic intervention.

There is a lot of controversy about the effect of Levodopa on the swallowing of patients with PD^{22,23,28-32}. Although the literature describes with great precision the improvement of the classical symptoms of the disease – such as resting tremors, rigidity and bradykinesia – with the use of this medication^{22,33-35}, there is no consensus on its effect on swallowing.

In the study of Fuh et al.²² there was improvement in swallowing after Levodopa therapy merely in a few patients. Monte et al.²³, on the other hand, reports improvement of swallowing in dyskinesic patients, associated to high doses of the medication.

Bushmann et al.³¹, reported inconsistent improvement in some aspects of swallowing, while Calne et al.³⁰ and Hunter et al.²⁹ did not find improvement of swallowing associated to medication.

Já Lim³² describes a reduction of swallowing efficiency after medication, while the meta-analysis carried out by Menezes and Melo³⁶ concluded that Levodopa does not improve dysphagia in PD.

Such controversy can be associated to the clinical type (predominant symptom) of the PD, since the diversity and differences of results found in relation to the dysphagia's response in PD, after Levodopa therapy, may have happened because of a lack of consideration of such clinical symptoms – predominant in the studied sample – which may present different responses to the medication. According to Robichaud et al.³⁵, the specific neural mechanisms caused by the medication which improve motor function are not clear.

Some authors^{27,29,37} suggest that the oral phase of swallowing presents the best results after Levodopa treatment and that this happens because it is considered a voluntary contraction. Thus the striated muscles involved suffer extrapyramidal influence³⁸ and as the alterations of this oral phase are mainly caused by rigidity and bradykinesia, it could be more sensitive to dopaminergic stimulation than the pharyngeal and esopharyngeal phase, which is of reflex reaction.

Such a statement corroborates with findings of Fuh et al.²² which found a reduction in bradykinesia and rigidity of the tongue after Levodopa, which could have influenced swallowing improvement of

half the evaluated subjects. However, one of these subjects presented swallowing improvement in the oral phase and worsening in the pharyngeal phase

Hunter et al.²⁹ said that although some authors suggested that rigidity and oral bradykinesia could be involved in abnormalities in this phase, variables of voluntary control such as number of tongue elevations and duration of oral phase, do not present improvement in his study. This corroborates with Nilsson,²⁸ who stated that the dysfunctions in the oral and pharyngeal phase of PD are not caused by the reduction of dopamine, and that the depletion of another neurotransmitter could be the etiology of this dysfunction.

Some methodological aspects may have interfered in the diversity of the results found. Hunter et al.²⁹ highlights that the variables used in some studies may not have been sufficiently sensitive to detect improvement after the use of Levodopa. Moreover, there is variability in the evaluation formats, where the proofs used in the VF differ.

These aspects, in the studies of Fuh et al.²² and Monte, et al.²³, are reflected in the results of the quality evaluation of the articles, when using the Jadad scale.

There is great scarcity of information in the literature about the relationship between dysphagia in PD and the predominant clinical symptoms. The article of Fuh et al.²² discusses little about this subject, while that of Monte et al.²³ does mention dyskinesia, which is not one of the classical PD symptoms, but rather an alteration related to the duration of the disease and dose of Levodopa, that can induce involuntary movements³⁹ in 30%-50% of patients after 2 to 5 years of treatment²⁰.

■ CONCLUSION

The articles analyzed in this systematic revision do not satisfactorily clarify the relationship between dysphagia and the clinical types of PD. Regarding the response of dysphagia to Levodopa therapy, the authors were controversial, which leaves a great gap to be filled by new studies that may better clarify this question, so as to contribute with more specific and efficient therapeutic interventions for the treatment of dysphagia in Parkinson's Disease.

RESUMO

A disfagia é um sintoma comum na doença de Parkinson, porém a causa e o mecanismo permanecem obscuros. Sabe-se que manifestações disfágicas podem provir de sintomas motores característicos da doença de Parkinson. Sendo assim, o estudo tem como objetivo investigar se a literatura indica a relação entre disfagia e os tipos clínicos (sintomas predominantes) na doença de Parkinson, e se a Levodopa influencia na deglutição desses pacientes. A busca foi realizada utilizando as bases de dados: portal da Bireme (Medline, Lilacs, Ibecs, Scielo, Biblioteca Cochrane, entre outros bancos desse portal) e portal Pubmed. Não houve restrição quanto ao ano de publicação e idioma. Os descritores utilizados foram: Parkinson or Parkinsonism and Deglutition or Swallowing or Swallow and Dysphagia and Levodopa. Foram encontrados 29 artigos, dos quais apenas 2 foram incluídos segundo os critérios de elegibilidade. Porém os artigos selecionados não fazem uma relação clara entre a disfagia e os sintomas clássicos da doença de Parkinson, entretanto demonstram resultados que apontam para uma melhora da deglutição após levodopa em alguns pacientes ou em pacientes com discinesia. São necessários novos estudos que possam esclarecer tal pergunta, contribuindo para nortear intervenções terapêuticas mais específicas e eficazes.

DESCRIPTORES: Doença de Parkinson; Transtornos Parkinsonianos; Deglutição; Transtornos da Deglutição; Levodopa

■ REFERENCES

1. Barbosa ER, Sallem FAS. Doença de Parkinson – Diagnóstico. *Neurociências*. 2005;13(3):158-65.
2. Coelho MS, Patrizzi LJ, Oliveira APR. Impacto das alterações motoras nas atividades de vida diária na Doença de Parkinson. *Neurociências*. 2006; 14(4):178-81.
3. Scalzo P, Kummer A, Cardoso F, Teixeira AL. Depressive symptoms and perception of quality of life in Parkinson's disease. *Arq Neuropsiquiatr*. 2009;67(2-A):203-8.
4. Morris ME. Movement disorders in people with Parkinson disease: a model for physical therapy. *Physical Therapy*. 2000;80(6):578-97.
5. Machado A. *Neuroanatomia Funcional*. São Paulo: Atheneu; 2000: 252-3.
6. Meneses MS, Teive HAG. Doença de Parkinson. Rio de Janeiro: Guanabara Koogan S.A.; 2003. p. 1.
7. Duus P. Diagnóstico Topográfico em Neurologia. Editora Cultura Médica. 4 ed. Rio de Janeiro: 1989: 204-5.
8. Souza CFM, Almeida HCP, Sousa JB, Costa PH, Silveira YSS, Bezerra JCL. A doença de Parkinson e o processo de envelhecimento motor: uma revisão de literatura. *Rev Neurocienc* 2011;19(4):718-23.
9. Flores FT, Rossi AG, Schmidt PS. Avaliação do equilíbrio corporal na doença de Parkinson. *Arq. Int. Otorrinolaringol*. 2011;15(2):142-50.
10. Rubert VA, Reis DC, Esteves AC. Doença de Parkinson e exercício físico. *Rev Neurocienc* 2007;15(2):141-6.
11. Christoforetti G, Formiga CKMR, Borges G, Stella F, Damasceno BP. Aspectos físicos e mentais na qualidade de vida de pacientes com doença de Parkinson idiopática. *Fisioter Pesq*. 2009;16(1):65-9.
12. Gasparim AZ, Jurkiewicz AL, Marques JM, Santos RS, Marcelino PCO, Herrero-Junior F. Deglutição e tosse nos diferentes graus da doença de Parkinson. *Arq. Int. Otorrinolaringol*. 2011;15(2):181-8.
13. Troche MS, Huebner I, Rosenbek JC, Okun MS, Sapienza CM. Respiratory-swallowing coordination and swallowing safety in patients with Parkinson's disease. *Dysphagia*. 2011;26:218-24.
14. Gross RD, Atwood Jr CW, Ross SB, Eichhorn KA, Olszewski JW, Doyle PJ. The coordination of breathing and swallowing in Parkinson's disease. *Dysphagia*. 2008;23:136-45.
15. Belo LR, Lins SC, Cunha DA, Lins O, Amorim CF. Eletromiografia de superfície da musculatura supra-hióidea durante a deglutição de idosos sem doenças neurológicas e idosos com Parkinson. *Rev. CEFAC*. 2009;11(2):268-80.
16. Yamada EK, Siqueira KO, Xerez D, Koch HÁ, Costa MMB. A influência das fases oral e faríngea na dinâmica da deglutição. *Arq Gastroenterol*. 2004;41(1):18-23.
17. Walker RW, Dunn JR, Gray WK. Self-reported dysphagia and its correlates within a prevalent population of people with Parkinson's disease. *Dysphagia*. 2011;26:92-6.
18. Azevedo LL, Cardoso F. Ação da levodopa e sua influência na voz e na fala de indivíduos com

doença de Parkinson. *Rev. Soc. Bras. Fonoaudiol.* 2009; 14(1):136-41.

19. Pieruccini-Faria F, Menuchi MRTP, Vitória R, Gobbi LTB, Stella F, Gobbi S. Parâmetros cinemáticos da marcha com obstáculos em idosos com Doença de Parkinson, com e sem efeito da levodopa: um estudo piloto. *Rev. bras. Fisioter.* 2006;10(2):233-9.

20. Poewe W. The natural history of Parkinson's disease. *J Neurol.* 2006; 253(Suppl.7): VII/2-VII/6.

21. Gonçalves LGT, Alvarez AM, Arruda MC. Pacientes portadores da doença de Parkinson: significado de suas vivências. *Acta Paul Enferm.* 2007;20(1):62-8.

22. Fuh J, Lee R, Wang S, Lin C, Wang P, Chiang J, Liu H. Swallowing difficulty in Parkinson's disease. *Clinical neurology and neurosurgery.* 1997;99:106-12.

23. Monte FS, Silva-Júnior FP, Braga-Neto P, Souza MAN, Bruin VMS. Swallowing abnormalities and dyskinesia in Parkinson's disease. *Movement disorders.* 2005;20:457-62.

24. Sampaio RF, Mancine NC. Estudos de Revisão Sistemática: Um Guia para Síntese Crítica da Evidência Científica. *Rev. bras. fisioter.* 2007;11(1):83-9.

25. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ et al. Assessing the Quality of Reports of Randomized Clinical Trials: Is Blinding Necessary? *Controlled Clinical Trials.* 1996;17:1-12.

26. Potulska A, Friedman A, Królicki L, Spychala A. Swallowing disorders in Parkinson's disease. *Parkinsonism and related disorders.* 2003;9:349-53.

27. Tison F, Wiart L, Guatterie M, Fouillet N, Lozano V, Henry P, Barat M. Effects of central dopaminergic stimulation by apomorphine on swallowing disorders in Parkinson's disease. *Movement disorders.* 1996;11(6):729-32.

28. Nilsson H, Ekberg O, Olsson R, Hindfelt B. Quantitative assessment of oral and pharyngeal function in Parkinson's disease. *Dysphagia.* 1996;11:144-50.

29. Hunter PC, Crameri J, Austin S, Woodward MC, Hughes AJ. Response of parkinsonian swallowing dysfunction to dopaminergic stimulation. *Journal of neurology.* 1997;63:579-83.

30. Calne DB, Shaw DG, Spiers ASD, Stern GM. Swallowing in parkinsonism. *Br J Radiol.* 1970;43:456-7.

31. Bushmann M, Dobmeyer SM, Leeker L, Perlmutter JS. Swallowing abnormalities and their response to treatment in Parkinson's disease. *Neurology.* 1989;39:1309-14.

32. Lim A, Leow L, Huckabee ML, Frampton C, Anderson T. A pilot study of respiration and swallowing integration in Parkinson's disease: "on" and "off" levodopa. *Dysphagia.* 2008;23:76-81.

33. Braak H, Ghebremedhin E, Rüb U, Bratzke H, Del Tredici K. Stages in the development of Parkinson's disease-related pathology. *Cell and tissue research.* 2004;318:121-34.

34. Wolters EC, Braak H. Parkinson's disease: premotor clinico-pathological correlations. *Journal of neural transmission supplementum.* 2006;70:309-19.

35. Robichaud JA, Kerstin D, Comella CL, Corcos DM. Effect of medication on emg patterns in individuals with Parkinson's disease. *Movement disorders.* 2002;17(5):950-60.

36. Menezes C, Melo A. Does levodopa improve swallowing dysfunction in Parkinson's disease patients? *Journal of clinical pharmacy and therapeutics.* 2009;34:673-6.

37. Nagaya M, Kachi T, Yamada T, Igata A. Videofluorographic study of swallowing in Parkinson's disease. *Dysphagia.* 1998;13:95-100.

38. Fonda D, Schwarz J. Parkinsonian medication one hour before meals improves symptomatic swallowing: a case study. *Dysphagia* 1995;10:165-6.

39. Aviles-Olmos I, Martinez-Fernandez R, Foltynie T. L-dopa-induced dyskinesias in Parkinson's disease. *European neurological journal.* 2010;2(2):91-100.

Received on: August 23, 2012

Accepted on: January 17, 2013

Mailing address:

Douglas Monteiro da Silva.

Rua das Tulipas, 4b Rio Doce

Olinda - PE - Brasil

CEP: 53150-700

E-mail: dougmonteiro05@gmail.com