

**Brief Communication**  
**Comunicação Breve**

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# Jaw movement in people with Parkinson's Disease

## *Características do percurso da movimentação mandibular dos diferentes tipos de Doença de Parkinson*

### Keywords

Parkinson  
 Jaw  
 Motion  
 Chewing  
 Elders

### ABSTRACT

This study aimed to characterize the amplitude and speed of isolated jaw movements and chewing using electrognathography in a volunteer and to compare these data with those of two other Parkinson Disease (PD) subjects, differentiated by the motor characteristics. Method: The 3 participants were divided into three categories: one with 1 non-PD volunteer, a second category with 1 volunteer characterized by Parkinson's hypokinesia, and a third with 1 volunteer characterized by Parkinson's tremor. Results: There were differences among the three groups; however the most significant was between the non-PD and the PD-rigidity, in the amplitude and speed when performing the jaw movements and chewing. Factors related to the adaptive and compensatory processes derived from rigidity process seemed to better explain the observed changes among the PD groups.

### Descritores

Parkinson  
 Mandíbula  
 Movimento  
 Mastigação  
 Idosos

### RESUMO

O objetivo deste trabalho foi caracterizar a amplitude e a velocidade dos movimentos mandibulares isolados e mastigatórios avaliados por eletrognatografia de dois indivíduos com Doença de Parkinson (DP) e confrontar esses dados com os de um voluntário sem a DP. Os três participantes foram divididos em três categorias: voluntário sem DP, paciente com DP e rigidez predominante (DP-rigidez) e paciente com DP e tremor predominante (DP-tremor). Foram encontradas diferenças entre as três categorias, porém com maior importância entre o indivíduo sem DP e o com DP-rigidez, na amplitude e na velocidade, quando da realização dos movimentos mandibulares e mastigatórios. Os fatores relacionados aos processos adaptativos e compensatórios derivados da diminuição da ação dopaminérgica pareceram explicar melhor as alterações observadas na movimentação mandibular no grupo com DP.

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## INTRODUCTION

Movement disorders caused by Parkinson's disease (PD) can affect the whole musculoskeletal system, including the muscles of the stomatognathic system. Sometimes, subjects with the disease may predominantly have one of the three symptoms of the pathology, namely: rigidity, tremor, and slowness<sup>(1-4)</sup>.

Jaw movements (JMs), chewing, speech, and swallowing are among the functions of the stomatognathic system most affected by PD. The precise and objective assessment of the functions of the stomatognathic system can help the speech-language pathologist to adjust the therapeutic goals according to the patient needs<sup>(5-7)</sup>.

Consequently, this study aimed at identifying the jaw motion path, range of motion, and velocity during isolated JMs and chewing in the subjects with and without PD.

## METHODS

This was a cross-sectional study conducted at the Neurology Clinic, approved by the Research Ethics Committee of the Federal University of Pernambuco (Process No. 353.911). The study was a characterization project with two phases: screening and millimetric scanning of the range of motion, velocity, and motion path of JMs.

The study sample comprised three subjects, matched for gender and age and differentiated according to gross motor characteristics. Participants included an otherwise healthy individual without PD, a patient with PD and predominant rigidity (PD-rigidity), and a patient with PD and predominant tremor (PD-tremor).

After classifying participants according to their motor condition, screening was performed based on previous studies that dynamically and statically described the structures that are directly and indirectly involved in JMs<sup>(8)</sup>.

After anamnesis and clinical evaluation of the oral health status, the electrognathography (EGN) was performed. For that purpose, volunteers were comfortably seated in a chair, with a 90-degree angle of flexion at the hip, knees, and ankles, hands placed on their thighs, head erect, and gaze directed forward. Afterward, volunteers received all the guidelines on how the examination would be performed.

The equipment used was a JT-3D™ electrognathograph, manufactured by BioRESEARCH®, and the software used to read the data collected during the EGN. For the exam, a small magnet was attached to the labial surface of the lower incisors, corresponding to the midline level. Subsequently, the head support was adjusted symmetrically.

Following the protocol suggested by the equipment manufacturer, during the JMs assessment, the volunteers were asked to open their mouths to the maximum, return to the closed position, make lateral movements to the right and to the left to the maximum, and always return to the initial position after each excursion, with a closed mouth. Subsequently, JMs range of motion and velocity were measured in the three orthogonal spatial planes, which can be represented in the three-dimensional envelope of motion in millimeters<sup>(9)</sup>.

Masticatory cycle was assessed in a different projection, in which 25 g of bread was offered to subjects to analyze the preferred chewing side.

JMs and the consequent movement of the magnetic sensor were captured by the electrognathograph and transmitted to a laptop. The laptop was used to observe the graphic movements of mandibular symmetry as well as range of motion and velocity of the masticatory cycle. Data related to the symmetry of jaw opening, the lateral movements to the right and the left, and the preferred chewing side were verified and stored on the computer for later analysis as well as registered in the EGN chart.

All the information was organized in a spreadsheet using Excel for Windows®, 2007 version, in which the statistical-descriptive parameters mean, median, and standard deviation were analyzed. In view of the small sample size, it was not possible to collect analytical statistics.

## RESULTS

We analyzed three areas related to JMs and chewing (range of motion, velocity, and motion path), comparing the range and path of the healthy volunteer with those of the patient with PD-tremor. The velocity of the healthy volunteer was compared with the patient with PD-rigidity.

The analyses of results and JMs characteristics during the opening of the mouth are described in Table 1.

With regard to the range of the motion of mouth opening during JMs and chewing, we observed that there was a difference between the patient with predominant PD-rigidity and the other two non rigid subjects, the volunteer and the patient with PD-tremor (Figure 1).

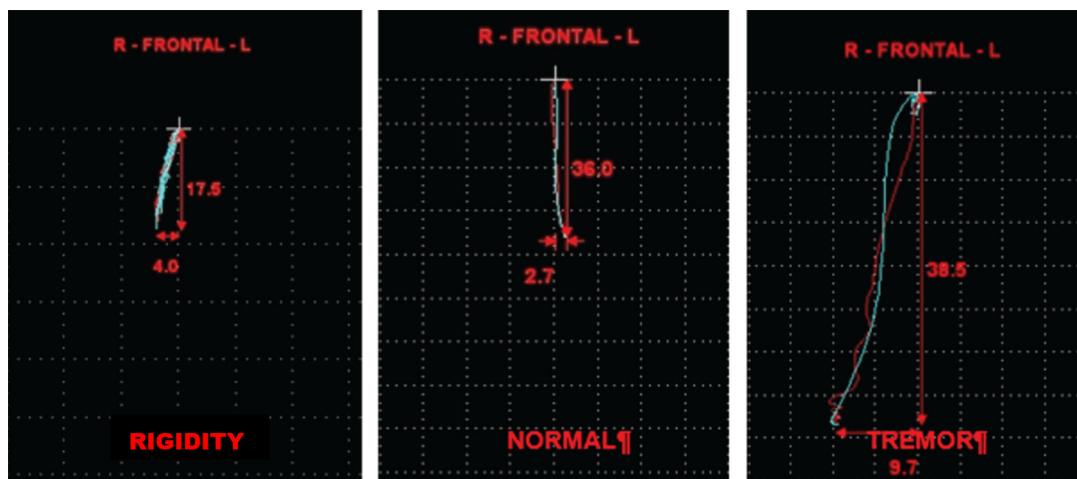
Regarding velocity during the mouth-opening movement in the JMs and chewing, we observed that there was a noticeable delay in the displacement of the jaw during the requested task when comparing the healthy volunteer with the patient with PD-rigidity (Figure 2).

Analyzing jaw path millimetrically during masticatory movements and JMs, we observed that there were considerable eccentric deviations from the midline in the patient with PD-tremor compared with the volunteer without PD (Figure 3).

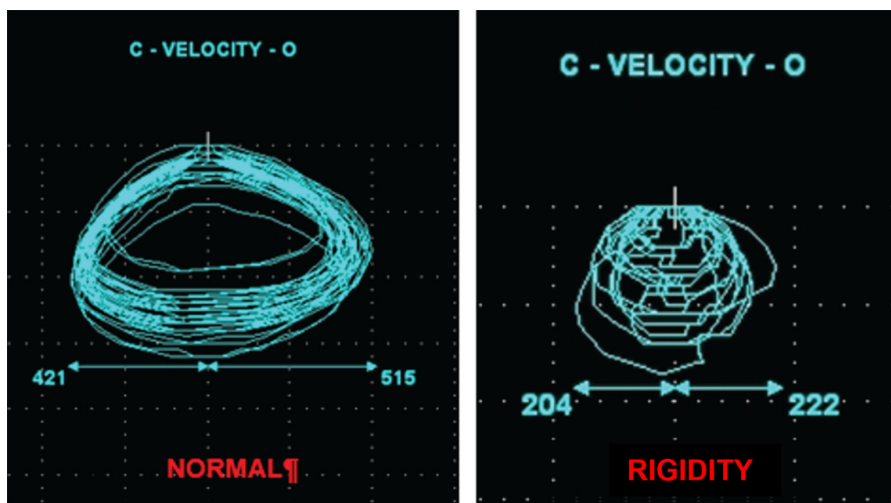
**Table 1.** Study of opening movement of the jaw

| GROUPS  | JAW RANGE OF MOTION (Figure 1) |
|---|--------------------------------|
| HEALTHY   | 36 mm                          |
| PD TREMOR   | 38.5 mm                        |
| PD RIGIDITY   | 17.5 mm                        |
| VELOCITY OF MOUTH OPENING (Figure 2)                |                                |
| HEALTHY   | 468 mm/s                       |
| PD RIGIDITY   | 213 mm/s                       |
| DEVIATION OF THE OPENING PATH OF THE JAW (Figure 3) |                                |
| HEALTHY   | 2.7 mm                         |
| PD TREMOR   | 9.7 mm                         |

Caption: PD = Parkinson's disease; mm = millimeters; mm/s = millimeters per second



Caption: R = Right; L = Left  
 Figure 1. Charts of the jaw range of motion



Caption: C = Closing; O = Opening  
 Figure 2. Charts of the velocity of mouth opening

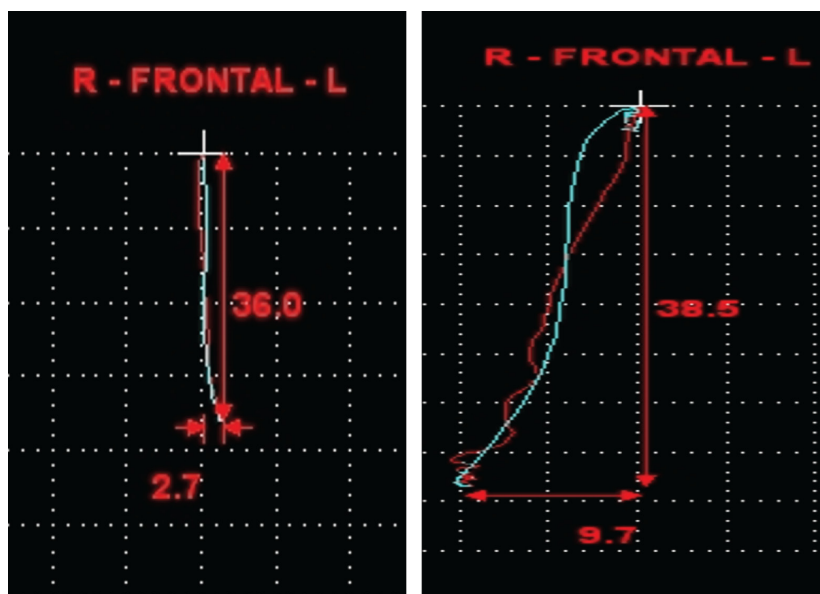


Figure 3. Charts of the opening path of the jaw

## DISCUSSION

Studies on the velocity, the range in motion, and the path of body, and JMs have been performed in other research fields such as neurology, odontology, physiotherapy, and speech-language pathology.

A prior systematic review of the literature conducted by the team found reports similar to the findings in this brief description of JMs in patients with PD<sup>(10-14)</sup>.

JMs characteristics and their correlation to parameters that are predominant, which are classified and shown in the Hoehn and Yahr scale<sup>(15)</sup> for patients with PD, are findings of paramount importance related to speech-language pathology that are still scarcely reported in the literature.

Patients with PD-tremor may present deviations in JMs without apparent harm to their range of motion or velocity, in contrast with subjects with PD-rigidity, who may develop changes in velocity and range of motion during JMs and chewing while maintaining the mandibular path without deviation.

The main findings in this study and in the literature were directly related to the dopamine levels found in the brain stem, considering that all the requested movements, despite being voluntary, were repetitive and partly unconscious; thus, they were controlled by subcortical structures.

## CONCLUSIONS

The results showed that PD creates changes in the stomatognathic system, which are parafunctions represented by alterations in the range of motion, path, and velocity of JMs.

Therefore, we can conclude that patients with PD-tremor may not have limitations on range of motion of jaw and masticatory movements, but they may present alterations in the path. However, patients with PD-rigidity have limitations on the range of motion and velocity of JMs and chewing, but without harming the JMs path.

This led us to believe that, with regard to the functions of the stomatognathic system, the differentiation in treatments offered to patients with PD is necessary, while adapting and improving the techniques used in therapy, assessment, and diagnosis in speech-language pathology for different groups of patients with PD. Conducting further studies with a larger number of patients and methodological criteria adapted to the sample characteristics is equally necessary.

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## Author contributions

LCAA was responsible for the writing, data collection, and data analysis; HJS was responsible for the ideation, analysis, and correction of the manuscript.