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ORIGINAL ARTICLE

Prevalence of TMD in Parkinson's disease: an observational study

Prevalência de DTM na doença de Parkinson: um estudo observacional

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Resumo

Introdução: A Doença de Parkinson (DP) apresenta características neurodegenerativas e progressivas, sendo tipicamente associada à perda de neurônios dopaminérgicos na região compacta da substância negra do mesencéfalo. Sintomas motores, como rigidez, bradicinesia e tremor de repouso, podem afetar a musculatura orofacial, resultando em sinais e sintomas semelhantes aos observados nas disfunções temporomandibulares (DTM). Consequentemente, comorbidades musculares, como a DTM, podem ser mascaradas, levando ao subdiagnóstico e até mesmo à ausência de tratamento. **Objetivo:** Avaliar a prevalência de DTM em indivíduos com DP e investigar sua associação com os estágios da doença. **Material e método:** A amostra foi composta por 31 pacientes, com idades entre 40 e 75 anos, diagnosticados com DP nos estágios 1, 2 e 3, de acordo com a escala de Hoehn & Yahr (H&Y). Os participantes foram recrutados no Ambulatório de Neurologia do Hospital de Clínicas da Universidade Federal de Uberlândia e avaliados por meio dos critérios diagnósticos para Disfunções Temporomandibulares (DC/TMD) e do Mini Exame do Estado Mental (MEEM). Todos os participantes foram avaliados sob condição medicamentosa habitual. **Resultado:** A amostra revelou discreto predomínio do sexo masculino entre os pacientes com DP. Embora não tenha sido encontrada associação estatisticamente significativa entre DP e DTM, observou-se maior frequência de casos de DTM no estágio 2 da doença, sendo as alterações articulares as mais prevalentes. **Conclusão:** Pacientes com DP não apresentaram associação significativa entre os estágios da doença e a DTM; entretanto, a presença de DTM, especialmente de origem articular, reforça a importância da avaliação clínica para evitar o subdiagnóstico nessa população.

Descritores: Disfunções da articulação temporomandibular; doença de Parkinson; dor facial.

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Abstract

Introduction: Parkinson's Disease (PD) has neurodegenerative and progressive characteristics and is typically associated with the loss of dopaminergic neurons in the compact region of the substantia nigra of the midbrain. Motor symptoms such as rigidity, bradykinesia, and resting tremor can affect the orofacial muscles, resulting in signs and symptoms similar to those of Temporomandibular Disorders (TMD). As a result, muscular comorbidities like TMD may be masked, leading to underdiagnosis and even lack of treatment. **Objective:** To evaluate the prevalence of TMD in individuals with PD and to investigate association with disease stages. **Material and method:** The sample consisted of 31 patients, aged between 40 and 75 years, with PD stages 1, 2, and 3, according to the Hoehn & Yahr (H&Y) scale. The individuals were recruited from the Neurology Clinic at the Clinical Hospital of the Federal University of Uberlândia and analyzed using the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) and questionnaire and the Mini-Mental State Examination (MMSE). All participants were evaluated under their usual medicated condition. **Result:** The sample revealed a slight male predominance among PD patients. Although no significant association was found between PD and TMD,a higher frequency of TMD cases was observed in patients at stage 2 of PD. Joint disorders were the most prevalent subtype. **Conclusion:** Patients with PD did not show a significant association between disease stages and TMD; however, TMD, especially joint disorders, was observed, highlighting the importance of clinical evaluation to avoid underdiagnosis in this population.

Descriptors: Temporomandibular joint disorders; Parkinson disease; facial pain.

INTRODUCTION

Parkinson's disease (PD) is a progressive, idiopathic neurodegenerative condition that primarily affects the dopaminergic neurons of nigrostriatal pathway[1]. It is characterized by

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bradykinesia, resting tremor, and rigidity, as well as postural instability and gait disturbances. PD is the second most common neurodegenerative disease, surpassed only by Alzheimer's disease[2]. The severity of PD is commonly assessed using the Hoehn and Yahr (HY) scale, in which stages 1 to 2 indicate mild disability, stages 2.5 to 3 indicate moderate disability, and stages 4 to 5 severe disability[3].

The temporomandibular joint (TMJ), a key component of the stomatognathic system, is composed of several structures, enabling it to perform a range of movements[4]. Temporomandibular disorders (TMD) comprise a group of conditions affecting the TMJ, masticatory muscles, and associated structures, being a biopsychosocial disorder influenced by genetic and environmental factors[5].

The motor symptoms associated with Parkinson's disease also affect the facial and masticatory muscles, which are similarly involved in TMD. These alterations may lead to involuntary jaw movements, impaired mastication, and swallowing difficulties[6]. Studies have reported a higher prevalence of TMD symptoms among individuals with neurological disorders, such as multiple sclerosis, PD, and stroke, among others[7]. However, it is noteworthy that these TMD prevalence data are primarily based on self-reported symptoms rather than standardized clinical diagnostic criteria[7,8]. Furthermore, the literature includes evidence of a concurrence between PD and TMD, and some studies suggest that TMD may be even more common in patients with Parkinson's disease than in the general population[8].

There are few epidemiological studies investigating TMD in PD patients, and those that exist often lack standardized diagnostic tools, relying instead on self-reported questionnaires or non-validated clinical assessments. The Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) are considered the gold standard for TMD diagnosis, as it provides validated and reliable clinical and psychosocial assessment protocols, improving diagnostic accuracy and reproducibility across studies[9].

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Evaluating the prevalence and association between PD stages and TMD is essential, as only a limited number of studies have addressed these comorbidities. Consequently, issues related to the impact of both conditions on pactients daily functioning remain underexplored. Furthermore, TMD symptoms may be underdiagnosed or misinterpreted in individuals with PD, highlighting the need for more accurate and standardized assessments. Despite growing interest in this topic, the relationship between PD progression and TMD remains unclear.

Therefore, the aim of this study was to evaluate the prevalence of temporomandibular disorders and to investigate their association with the stages of Parkinson's disease using the DC/TMD diagnostic criteria. It was hypothesized that the prevalence of TMD increases with the progression of PD.

METHODOLOGY

Study design

This study was designed as an observational cross-sectional study conducted with patients diagnosed with Parkinson's disease (PD). The study was carried out at the Neurology Clinic of the Clinical Hospital of the Federal University of Uberlândia between June 2023 and December 2025. Participants were recruited from patients receiving care at the Neurology Clinic during the study period. Eligible individuals were invited to participate consecutively, according to the inclusion and exclusion criteria. All participants were evaluated under their usual medicated condition, and no medication suspension was required prior to the assessments. Participants were not instructed to discontinue or modify their medication regimen, in order to ensure safety and to reflect on their routine clinical condition. All clinical assessments and questionnaires were administered by the same researcher, on the same day, and were read aloud to participants to ensure comprehension and standardization of data collection. The study was approved by the Research Ethics Committee of the Federal University of Uberlândia (CAAE

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number: 12349019.7.0000.5152), and all participants provided written informed consent prior to inclusion.

Sample

The sample size was estimated based on a reported prevalence of 30% of temporomandibular disorders (TMD) in patients with Parkinson's disease from a previous study[10], considering a 5% margin of error and a 95% confidence level. A non-probabilistic convenience sample of 31 patients diagnosed with PD was included in the study. Participants were selected according to the established inclusion and exclusion criteria.

Eligibility criteria

Inclusion criteria: individuals aged over 18 years, diagnosed with mild to moderate PD by the neurology team, and presenting adequate cognitive function as determined by the Mini-Mental State Examination (MMSE).

Exclusion criteria: individuals with dentofacial deformities, other joint or muscle diseases, those who exhibited TMD symptoms before their PD diagnosis, or who had undergone treatment for TMD, as well as patients in stages 4 and 5 according to the Hoehn and Yahr scale were excluded from the study.

A written informed consent form was obtained from all participants prior to data collection. Only those who provided consent were included in the sample.

Clinical assessment and questionnaires

Three questionnaires were used to assess and characterize the participants: one to evaluate the severity of PD, another to assess cognitive status, and a third to diagnose and

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classify TMD. All instruments were administered by the same researcher, on the same day, and were read aloud to participants to ensure comprehension.

Questionnaire 01 - Hoehn and Yahr Scale (HY): The Hoehn and Yahr scale, developed by Melvin Yahr and Margaret Hoehn in 1967, assesses the disability level in PD patients by classifying them stages 1 to 2 indicate mild disability, stages 2.5 to 3 indicate moderate disability, and stages 4 to 5 severe disability.[3] The classification considers whether the disease's effects are unilateral or bilateral and whether there are balance deficits or limitations in standing ability. The scale focuses primarily on motor symptoms and does not account for non-motor symptoms such as cognitive impairment, depression, or sleep disturbances, which are also common in PD. According to the criteria used for this study, only patients up to stage 3 were evaluated, as these stages represent moderate PD, with fewer mobility and communication difficulties than in advanced stages (4 and 5).

Questionnaire 02 - MMSE: The Mini-Mental State Examination (MMSE) assesses cognitive impairment and mental functioning. The MMSE is a quick, easy-to-administer tool, commonly used in clinical and research settings. Each response is scored, with the total score ranging from 0 to 30 points, where higher scores indicate better cognitive functioning. Lower scores suggest cognitive impairment and may prompt further evaluation. However, the MMSE is not a diagnostic tool but a screening instrument. Factors such as educational background and cultural differences may influence the results, so these aspects must be considered when interpreting the scores[11]. In the present study, the interpretation of the MMSE considered the participants´ educational level, in order to minimize potential bias related to schooling. Only participants who demonstrated adequate cognitive ability, as determined by the MMSE, were included in the study.

Questionnaire 03 - DC/TMD: The Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) was used to diagnose and classify TMD in participants. This tool

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provides a comprehensive assessment of patients with TMD symptoms, including pain, restricted movement, joint noises, and other issues. The DC/TMD system consists of two axes: Axis 1 identifies and classifies the physical conditions of TMD, while Axis 2 assesses the severity of pain and the psychological impact of the disorder. Both axes were applied in this study. This system was developed by the American Academy of Orofacial Pain (AAOP) in collaboration with the International Research Diagnostic Criteria for TMD Consortium[12].

After administering the instruments and analyzing the DC/TMD data, information such as sex, PD stage, the presence or absence of TMD, and participant classification was collected.

Control of medication-related variables

All participants were under regular pharmacological treatment for PD at the time of evaluation. No medication washout was performed; assessments were conducted under the patients' usual medicated condition, reflecting their typical clinical status. This approach was adopted to ensure participant safety and to evaluate TMD in the context of the patients' routine disease management. The potential influence of medication on the results is acknowledged as a limitation of this study.

Statistical analysis

Data were analyzed using SPSS for Windows, version 26 (IBM Corp., Armonk, NY, USA)[13]. Descriptive statistics were performed to summarize the sample characteristics. The association between Parkinson's disease stages and the presence of temporomandibular disorders (TMD) was assessed using the Chi-square test. The level of statistical significance was set at $p < 0.05$.

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RESULT

Thirty-one patients diagnosed with PD were evaluated in this study. All participants demonstrated adequate cognitive function, as determined by the MMSE screening, and were therefore eligible for inclusion in the study.

Table 1 presents the absolute distribution of patients across PD stages, according to sex. Stage 2 showed the highest proportion of patients (n = 16; 51.6%), followed by stage 3 (n = 12; 38.7%) and stage 1 (n = 3; 9.7%). A higher proportion of male participants was observed in stages 2 (38.7%) and 3 (32.3%).

Table 2 shows the distribution of patients according to PD stage, sex, and the presence or absence of TMD. Overall, most participants did not present TMD (n = 22; 71.0%). Among those diagnosed with TMD (n = 9; 29.0%), the highest proportion was observed in men with stage 3 PD (n = 3; 9.7%).

Table 3 presents the distribution of TMD subtypes. Joint disorders accounted for the majority of TMD cases (70%), while muscular disorders represented a smaller proportion (30%). Considering the total sample (n=31), joint disorders were identified in 16.1% and muscular disorders in 9.7% of all participants. Disc displacement was the most frequently observed joint disorder. A higher occurrence of disc displacement without reduction was identified in women with stage 1 PD (6.5%) and in men with stage 3 PD (6.5%). Regarding muscular disorders, myalgia was observed in both men and women with stage 2 PD (3.2% each).

The association between TMD and PD stages is presented in Table 4. No statistically significant association was found between PD stage and the presence of TMD (p = 0.325). However, a higher frequency of TMD cases was observed in patients at stage 2 of PD (n=4; 40%), without statistical significant.

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Additionally, the sample was further characterized based on clinical and demographic variables. All participants were aged between 50 and 70 years. Regarding mandibular function, limited mouth opening was observed in 21 patients, classified as mild in 16 individuals and severe in 5, while 10 patients showed no limitation. The presence of orofacial pain was reported in some participants; however, this finding appeared to be influenced by the pharmacological treatment used. Joint sounds, such as clicking, were observed in patients diagnosed with articular TMD.

DISCUSSION

The present study evaluated the prevalence of TMD in patients with PD and their association with disease stages. The initial hypothesis that TMD prevalence increases with PD progression was not supported, as no statistically significant association was observed between PD stages and the presence of TMD ($p = 0.325$). However, this finding should be interpreted with caution, as the absence of statistical significance does not necessarily indicate the absence of a true association, but may reflect limitations related to sample size and statistical power.

PD is a neurodegenerative condition that predominantly affects the older population, with a higher prevalence in men than in women[14]. With population aging accelerating globally, studying diseases directly linked to senescence is crucial in the context of public health. Understanding the prevalence of potential comorbidities such as TMD in this group offers opportunities to improve quality of life through interventions targeting treatable conditions, like muscle and temporomandibular joint disorders, within the scope of a degenerative disease such as PD.

In the present study, a predominance of male participants was observed, which is consistent with the known epidemiological profile of PD.[15]. However, a higher proportion of TMD was identified among female participants, despite their smaller representation in the

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sample. This finding is in agreement with previous studies reporting a higher prevalence of TMD in women, both in PD and non-PD populations. These results suggest that sex-related factors may influence TMD occurrence independently of PD progression.[16,17]

No significant association was found between PD stages and the presence of TMD. However, a higher frequency of TMD cases was observed in patients at stage 2 of PD, which may suggest a potential trend that was not detected as statistically significant due to the limited sample size. A systematic review with meta-analysis suggested a possible association between TMD and PD, highlighting the importance of raising awareness of this correlation among dental professionals so they can provide better diagnoses and treatment for PD patients who report orofacial pain[17]. However, a study that assessed the prevalence of TMD in fifty-nine PD patients found a significant relationship between PD and TMD, but did not relate advanced stages of parkinsonism to a higher risk of TMD[15,18]. A recent scoping review showed that the prevalence of orofacial pain, TMD, chewing difficulties, and sensory disorders increases with greater PD severity[17,18]. It is important to note that many of these studies relied on self-reported symptoms or non-standardized diagnostic criteria, which may limit the comparability of results. In the present study, stage 2 showed the highest proportion of TMD cases, as presented in Table 4.

In contrast to previous investigations, the present study employed the DC/TMD protocol, which is considered a standardized and validated diagnostic tool. This methodological approach enhances the reliability and reproducibility of the findings, even in the absence of statistically significant associations.

The predominance of joint disorders, particularly disc displacement, observed in this study is consistent with findings reported in the literature. This finding is consistent with other studies reporting that articular disc displacement is the most common characteristic in PD patients diagnosed with TMD. Although Parkinson's disease primarily affects the neuromuscular system, its impact on motor coordination and mandibular function may

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contribute indirectly to joint alterations.[6,19]. However, the absence of a well-established direct relationship between PD and articular disc displacement reinforces the need for further investigation.

Another important factor to consider is the potencial influence of pharmacological treatment. Various types of drugs are used to treat PD, which can mask the presence of TMD in patients. This issue should be addressed in future studies. Among the medications prescribed for PD, some aim to increase dopamine levels, which alleviate symptoms like stiffness, bradykinesia, and tremor, but may also interfere with TMD diagnosis[18]. In the present study, all participants were assessed under their usual medicated condition, which helped standardize the evaluation and minimize this potential source of bias. When dopaminergic therapy is fully functional, there may be fewer reports of orofacial pain or dysfunction[20,21]. Therefore, examining all patients while they are on active drug therapy to avoid bias and to standardize therapy across the sample. In the present study, this approach was adopted, as all participants were evaluated under their usual medicated condition.

The current study presents the inherent limitations of a cross-sectional design. The small sample size (n=31) is also acknowledged as a limitation, which may have reduced the statistical power to detect significant associations. Further studies are needed to determine cause-and-effect relationships between the variables analyzed. A study that includes patients across all PD stages would be valuable to investigate whether duration and severity of PD are associated with orofacial pain. Such a study should also ensure a more balanced sample regarding sex and age, use standardized drug therapy, and investigate other factors within a more comprehensive therapeutic approach for individuals with PD. The current study presents no bias in terms of PD classification, as it was performed by a specialized medical team.

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CONCLUSION

This study suggests that patients with PD present a notable prevalence of TMD, particularly joint disorders, although no statistically significant association between PD stages and TMD was observed. While the initial hypothesis that TMD prevalence increases with PD progression was not confirmed, a numerically higher frequency of TMD cases was observed in stage 2 patients. A higher prevalence of TMD was also noted in females, consistent with existing research. These findings highlight the importance of routine TMD screening in PD patients, particularly as neuromuscular impairments and pharmacological treatment may mask or modify orofacial symptoms, potentially leading to underdiagnosis of this comorbidity.

AUTHORS' CONTRIBUTIONS

Conceptualization: Simamoto Junior PC, Soares Junior EC; Curation: Simamoto Junior PC, Rocha NAB, Simamoto Junior PC; Formal Analysis: Simamoto Junior PC, Raposo LHA; Investigation: Soares Junior EC, Rocha NAB, Simamoto Junior PC; Methodology: Soares Junior EC, Rocha NAB; Project administration: Simamoto Junior PC; Resources: Simamoto Junior PC; Supervision: Simamoto Junior PC; Writing - original draft: Simamoto Junior PC, Soares Junior EC, Rocha NAB; Writing - review & editing: Simamoto Junior PC; Raposo LHA.

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CONFLICTS OF INTERESTS

The authors declare that there were no conflicts of interest.

DATA AVAILABILITY

The data used to support the findings of this study can be made available upon request to the corresponding author.

CORRESPONDING AUTHOR

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Table 1 – Distribution of patients according to Parkinson's disease stage and sex (n = 31)

PD stage	**Men ♂(%)**	**Women ♀ (%)**	**Total (%)**
S1	0(0)	3 (9,7)	3(9,7)
S2	12 (38,7)	4 (12,9)	16 (51,6)
S3	10 (32,3)	2 (6,5)	12 (38,7)

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Table 2 – Distribution of temporomandibular disorders according to Parkinson's disease stage and sex

PD stage		**TMD (%)**	**Without TMD(%)**
S1	**Men** ♂	0(0)	0(0)
	Women ♀	2 (6,5)	1 (3,2)
S2	**Men** ♂	2 (6,5)	10 (32,3)
	Women ♀	1(3,2)	3(9,7)
S3	**Men** ♂	3(9,7)	7 (22,6)
	Women ♀	1 (3,2)	1(3,2)

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Table 3 - Distribution (%) of patients with PD across stages 1 to 3 according to the TMD type diagnosed using the DC/TMD questionnaire

PD stage		**Joint Disorders (%)**	**Muscular Disorders(%)**
S1	**Men** ♂	Not observed	Not observed
	Women ♀	DDR / DDnLnR (6,5)/ (6,5)	Not observed
S2	**Men** ♂	DJD (3,2)	MPR (3,2)
	Women ♀	Not observed	Mi (3,2)
S3	**Men** ♂	DDnR (6,5)	MH-TMD (3,2)
	Women ♀	DDsR (3,2)	Not observed

* DDR:disc displacement with reduction; DDnLnR:disc displacement without limitation and without reduction; DJD:degenerative joint disease; MPR:myofascial pain with referral; DDnR:disc displacement without reduction; MH-TMD:myalgia and headache attributed to TMD; Mi:myalgia.

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Table 4 - Association between temporomandibular disorders and Parkinson's disease stages (Chi-square test)

	Temporomandibular Disorder		
PD Stage	**Absent**	**Present**	**Total**
S1	1 (3.3%)	2 (6.4%)	3 (9.8%)
S2	13 (41.9%)	3 (9.6%)	17 (51.5%)
S3	8 (25.8%)	4 (12.9%)	11 (38.7%)
Total	22 (100.0%)	9 (100.0%)	31 (100.0%)

Chi-square test; $p = 0.325$.

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versão 29 de junho de 2020

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