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Effect of foot health and quality of life in patients with Parkinson disease: A prospective case-control investigation

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ABSTRACT

Background: Parkinson's disease (PD) is a common neurodegenerative disorder, characterised by the presence of motor disturbances. Therefore, it can be related to musculoskeletal and orthopaedic problems, particularly in the foot status, that are linked to a negative effect on overall health, mobility and social function.
Objective: The aim was to analyse the impact of foot health and quality of life in patients with Parkinson's disease and people without Parkinson's disease, with normalised reference scores, in the light of the values recorded with regard to foot health status and overall health.
Material and methods: This is a prospective case-control investigation. A sample of Parkinson's patients (n = 62) including 24 men and 38 women was recruited, and foot HQoL was measured using the Foot Health Status Questionnaire Spanish (Sp_FHSQ).
Results: The PD group recorded lower levels of foot health quality of life (HQoL) with lower scores on the Sp_FHSQ in general foot health, general health, physical activity, social capacity and vigour sub-scales. Regarding the rest of the sub-scales of the Sp_FHSQ, foot pain showed higher values in the PD group. Differences between the cases and control groups were analysed by means of a Mann–Whitney *U* test, showing statistical significance ($P < 0.05$).
Conclusions: PD presents an increased negative impact on foot health and quality of life which appears to be related to the chronic neurodegenerative disease.

1. Introduction

Parkinson's disease (PD) frequently causes gait alterations and together with Alzheimer's disease, is the main neurodegenerative disorder related to the central nervous system [1]. It affects 0.3% of the population, with a higher prevalence in individuals older than 60 years where it increases to 1%, and 3% in the over 80s [2]. The cases of PD may increase by more than 50% by 2030 [3] implying a high monetary burden on health systems [4].

In fact, the most frequently risk factor related to the aetiology of PD is aging, although genetic factors can be an influence if the pathology starts before the fifth decade [5,6].

Regarding gait parameter and foot problem symptoms, they are characterised by a decrease in stride length [7], and the PD population shows alterations in heel contact. Moreover relative to the swing phase, they are characterised by lowered uprising, increasing the fall risk [8,9].

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PD and chronical pathologies like Diabetes Mellitus, osteo articular and cardiovascular processes can affect HQol, and as a consequence of this, mental and general health [10].

For example, they can affect gait speed and increase fall risk due to balance alterations [11–13]. Furthermore, PD and frailty symptoms affect foot HQoL in these patients [14,15].

Regarding foot conditions in the PD population, foot disorders and diseases are present most frequently in the frail population group, comprising approximately 25% [16,17].

Consultations in general practitioners related to ankle and foot conditions with an osteo articular pain origin account for more than 8% [18]. Accordingly, suffering from PD may raise this predominance in older adults who have characteristic foot requirements that can be akin to more serious disorders [19], worsening foot health related quality of life HQoL [20]; and increasing the risk of falls [21,22].

For this reason, and taking into account that only a few previous studies have been carried out on PD subjects, the development of an investigation which correlates HQoL and PD will give clinicians the possibility to prevent future disabilities related to psychosocial and affective aspects related with general health that are different from specific PD symptoms [23].

In the literature, no references have been found for foot HQoL in the PD population with foot disorders, and therefore our hypothesis is that there are differences in the levels of HQoL in the PD population with foot disorders.

The aim was to analyse the impact of foot health and quality of life on patients with Parkinson's disease and people without Parkinson's disease, with normalised reference scores, in the light of the values recorded with regard to foot health status and overall health.

2. Methods

2.1. Design and sample

This is a prospective case-control investigation study carried out in a centre of excellence for Parkinson's disease in the city of Málaga (Spain) between September 2020 and December 2020. A consecutive and non-randomised sampling method was employed to recruit the 124 study subjects, obtaining their informed consent. The inclusion criteria were to be PD patients and healthy subjects between fifty and eighty-five years old, as PD is more prevalent in this age range [15].

Subjects were excluded if they were: immune-depressed patients with antecedents of foot and ankle fractures or surgery, cognitive disorders, or subjects who did not sign their consent to participate in the research, subjects who did not answer filiation questions or those who did not understand the participation rules.

2.2. Procedure

All data recording was carried out by a single senior researcher prior to the assessment. The demographic characteristics (age and gender), and predisposing factors were determined from medical history information using an identical protocol.

Then, subjects removed their shoes and hosiery, and a medical podiatric foot exam was performed to evaluate the following: 1) general appearance of the feet, 1) abnormalities of all the toes, 2) condition of all the toenails, 2) movements of rotation of the feet, 4) presence of arch types, 5) foot morphology type, and 6) skin pathology. Also, anthropometric values were recorded: height (cm) and weight (kg) with each subject in barefoot conditions and wearing light clothing, for the subsequent calculation of the body mass index (BMI) using Quetelet's equation (14).

After that, informants filled out the Sp_FHSQ [24,25], a clinimetric tool specifically designed for measuring foot HQoL parameters [26,27]. The Sp_FHSQ is divided into three blocks. First, 13 questions about foot HQol sub-scales: foot pain, foot function, footwear, and general foot health, with an adequate criterion, and construct validity (Cronbach $\alpha = 0.89–0.95$) and high retest reliability (intraclass correlation coefficient = 0.74–0.92), [27]. Furthermore, there are sub-scales with regard to physical activity, social capacity and vigour. The different items which make up the questionnaire can be answered using a Likert-type ordinary scale. With regards to score, it must be analysed by special software which provides a scale from zero to one hundred. Zero points correspond to the worst state of foot health and one hundred to the best possible condition.

2.3. Sample size calculation

The sample size was calculated for this study of cases and controls with specific levels of confidence, power, and groups of equal size using the Epidat 4.2 Programme (Consellería de Sanidade, Xunta de Galicia, Spain; Organización Panamericana de la Salud (OPS-OMS); Universidad CES, Colombia). A total sample size of 122 participants (61 per group) was established taking a confidence level of 70%, a power of 0.80, an odds ratio to detect of 2.0 and an expected proportion of exposed of 66.67%, and 50% in the controls. The total sample (124 participants) consisted of 62 cases (38 men and 24 women) and 62 controls (37 men and 25 women).

2.4. Ethical considerations

Prior to beginning the research, approval for conducting this study was obtained from the Ethics Committee of the University of Valencia in Spain. Informed consent was obtained from each participant after the purpose and process of the study had been explained and the privacy of the participants' information had been assured. The fact that their participation was entirely voluntary was also highlighted.

2.5. Statistical analysis

The Foot Health Status Questionnaire (Version 1.03) was administered to calculate HQoL values related to foot health. Statistical analysis was performed with 25.0v SPSS software (IBM Corp., Armonk, NY, USA) referring to an alpha error of 0.05 for a 95% confidence interval (CI).

Regarding the quantitative data, the Kolmogorov-Smirnov test was used to evaluate normality. All the data were distributed as parametric data (the Kolmogorov–Smirnov test showed a p-value lower than 0.05) and are described as mean ± standard deviation (SD) and range (minimum–maximum), and contrasts between both groups were compared with Student's *t*-test or the Mann–Whitney *U* test for independent samples.

Concerning categorical data, frequencies and percentages were applied to distinguish these values, and differences between both groups were contrasted with the Chi squared test.

3. Results

3.1. Descriptive data

A sample of 124 subjects completed the research and was divided into persons with Parkinson's disease (for case group, n = 62) and healthy matched-paired participants (for the control group, n = 62) showing an age division from 50 to 84 years old. Statistically significant differences were not shown ($p > 0.05$) between both groups for the descriptive data (Table 1).

A normal distribution was shown for age, height, weight and BMI ($P > 0.05$), and all items from the SP_FHSQ test.

3.2. Outcome measurements

The clinical inspection showed that in PD patients 56.4% (n = 35) had joint stiffness, 12.9% (n = 8), skin keratin disorders, 41.9% (n = 26)

Table 1
Descriptive data of the parkinson patients and healthy matched-paired controls.

Descriptive Data		Total Group Mean ± SD Range (n = 124)	Cases Mean ± SD Range (n = 62)	Controls Mean ± SD Range (n = 62)	p-Value
Age (years)		69.18 ± 9.12 (50–84)	69.23 ± 9.15 (50–84)	69.13 ± 9.15 (50–84)	0.097†
Weight (kg)		74.10 ± 14.84 (43–135)	73.36 ± 17.63 (43–135)	74.83 ± 11.49 (54–100)	0.582†
Height (m)		1.67 ± 0.09 (1.47–1.91)	1.66.37 ± 9.64 (1.47–1.91)	1.67 ± 7.80 (1.47–1.85)	0.690†
BMI (kg/m2)		26.61 ± 4.61 (16.16–40.31)	26.37 ± 5.24 (16.16–40.31)	26.85 ± 3.90 (19.83–35.43)	0.0563†
Sex (%)	**Male Female**	75 (60.5%) 49 (39.5)	38 (61.3%) 24 (38.7%)	37 (59.7%) 25 (40.3)	0.854 ‡

Abbreviations: BMI, body mass index; SD, standard deviation. In all the analyses, $p < 0.05$ (with a 95% confidence interval) was considered statistically significant. Median ± interquartile range, range (min–max) and † Student's *t*-test for independent samples were applied. ‡ Chi-squared test were used.

general foot pain, and 27.4% (n = 17) toe deformities. In healthy patients 1.6% (n = 1) had joint stiffness, 1.6% (n = 1) keratin disorders, 16.1% (n = 10) general foot pain, and 3.2% (n = 2) toe deformities. Moreover, 54.8% subjects showed predisposing factors like 21.8% (n = 27) vascular disabilities, 21.8% (n = 27) musculoskeletal disorders, 9.7% (n = 12) diabetes mellitus and overweight 4% (n = 5).

The variables that did not show a normal distribution were Age, Weight, BMI, Foot Pain, Foot Function, General Foot Health, General Health, Physical Activity and Social Capacity ($P < 0.05$) with Height, Footwear and Vigour showing a normal distribution ($P > 0.05$).

With regards to the comparison of the scores obtained with the FHSQ, results appear in Table 2. These scores were higher for the group without PD, with normalised reference values, both in the first section of the questionnaire, which assesses the informants' HQol related specifically to foot health, and in the second section, which assesses the informants' health in general.

The differences between the two groups were statistically significant ($p < 0.05$).

4. Discussion

The aim was to analyse the impact of foot health and HQol in patients with PD and people without PD, with normalised reference scores, in the light of the values recorded with regard to foot health status and overall health.

The alteration of foot HQol factors, especially in the PD population, requires adequate mechanisms for measurement. According to our results, foot pain was a factor present in the PD group, decreasing foot HQoL, for this reason it may be useful to employ the FHSQ with these subjects, in order to record their foot health status in the same line as the results of Bowen et al. [28].

Perceptions of foot health status and QoL have been demonstrated to be useful mechanisms for measuring pain post-treatment, determining foot health status [24].

Moreover, our study has shown that related to physical activity, social capacity and vigour patient presents lower scores of HQoL, showing poor HQoL levels in the PD group.

However, another study related to PD has only shown alterations related to gait parameters without reference to HQoL [15].

On the other hand, the results relative to foot pain and HQol obtained in another chronic disease population, have shown similar outcomes to those of our research [29].

Furthermore, balance disorders have been shown to decrease the HQol score, and these studies coincide with the results obtained in our research, as in the case of Martinez-Amat et al. and Pérez-Ros et al. [30,31].

Thus, gait and balance alteration can be related to PD characteristics, especially in patients with articular disabilities, and those with lower limb joint stiffness exhibited lower HQoL scores in the same line as the results obtained by Dionisio et al. [32].

The only exception to the results obtained in our research with Sp_FHSQ in PD subjects was in the foot function domain, which seems be related to the existence of foot disorders and the ageing process, in this respect, our results were similar to those of Rodríguez-Sanz et al. and other researchers [14,17].

Regarding the results obtained, it is worth indicating the importance of management and foot care by the clinician for preventing complications and foot disabilities, as this is a main issue in PD and a key point for increasing PD HQoL and autonomy. Despite the fact that the FHSQ has determined the degree of foot HQol [24,33], it has not been used in a cohort of PD patients [34].

Other symptoms different from general health status have been studied in the PD population as in the case of emotional disabilities and should be considered to measure the motivational dimension in future research [23]. As regards pain and limitation of movement due to fear, they have also been studied in Parkinson's subjects [35].

Several limitations of this research should be taken into account. A population from different countries may be useful to ameliorate the strength of this research. Likewise, an increased sample size would be useful to determine if there is some association between culture and the mechanisms involved in HQoL.

Future studies should incorporate populations from, and living in, different countries.

Table 2
Foot Health Status Questionnaire mean points for the parkinson patients and healthy matched-paired controls.

Domains FHSQ	Total Group Mean ± SD Range (n = 124)	Cases Mean ± SD Range (n = 62)	Controls Mean ± SD Range (n = 62)	p-Value
Foot Pain	78.00 ± 27.25 (0–100)	81.42 ± 23.07 (12.5–100)	74.59 ± 23.02 (0–100)	0.021*
Foot Function	47.38 ± 29.25 (0–100)	75.91 ± 29.09 (0–100)	81.05 ± 25.25 (0–100)	0.902*
Footwear	56.29 ± 27.65 (0–100)	45.83 ± 25.95 (0–100)	48.92 ± 32.34 (0–100)	0.796*
General Foot Health	55.81 ± 27.79 (0–100)	49.72 ± 24.80 (0–100)	62.86 ± 28.95 (0–100)	<0.001*
General Health	55.81 ± 27.79 (0–100)	47.25 ± 30.09 (0–100)	64.35 ± 22.44 (0–100)	<0.001*
Physical Activity	62.81 ± 32.40 (0–100)	48.75 ± 32.56 (0–100)	76.88 ± 25.57 (0–100)	<0.001*
Social Capacity	72.58 ± 26.18 (12.50–100)	61.29 ± 24.97 (12.5–100)	83.87 ± 22.34 (12.5–100)	<0.001*
Vigor	49.85 ± 22.62 (0–100)	39.51 ± 19.23 (0–100)	60.18 ± 21.09 (6.25–100)	<0.001*

Abbreviations: FHSQ = Foot Health Status Questionnaire; SD, standard deviation. Median ± interquartile range, (min–max) and Mann–Whitney *U* test were used*. In all the analyses, $P < 0.05$ (with a 95% confidence interval) was considered statistically significant.

5. Conclusions

PD present a greater negative impact on foot health and quality of life which appears to be related to the chronic neurodegenerative disease.

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