



## Effects of external cues on gait parameters of Parkinson's disease patients: A systematic review



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### ABSTRACT

**Objectives:** A systematic review to evaluate the benefits of external cues on the gait of PD patients and their impact on the quality of life, freezing and psychomotor performance was performed. The types of cues that could lead to more significant gains were analyzed.

**Methods:** We searched for randomized clinical trials (RCTs) and quasi-randomized clinical trial (QRCTs) that assessed the influence of different external cues on gait, freezing, quality of life and psychomotor performance.

**Results:** Of 259 articles collected, seven (six RCTs and one QRCT) were included in the methodological quality criteria (two consider visual cues, two consider auditory cues, one considers verbal instructions, one considers combined cues and one considers sensory cues). All of the data regarding the methodology, interventions, population and bias were described. Cues generally led to a statistically significant improvement in the step and stride length, speed of gait, cadence and UPDRS. None of these studies assessed the quality of life, and one study analyzed freezing.

**Conclusion:** Our review could show that external cues are effective for improving the gait parameters and psychomotor performance of PD patients. We need more studies to verify if the impact of this type of treatment could improve the quality of life of patients with PD.

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## 1. Introduction

Parkinson's disease (PD) is one of the most prevalent neurological diseases and is considered the second most common movement disorder [1]. The disease generally affects individuals over 50 years of age [2]. Its prevalence is estimated in different populations as an average of 50 to 260 cases per 100,000 people, affecting 3.3% of individuals over 65 years [3].

PD has motor and non-motor symptoms that usually respond partially to pharmacological intervention. Many of the motor symptoms respond well to levodopa, but the gait and postural impairment, freezing of gait (FoG) and falls do not have a good response to levodopa. Physical therapy is recommended to control these axial symptoms, but it is not always possible to obtain satisfactory responses to these problems.

Some systematic reviews show that conventional physical therapy improves the gait, functional mobility, balance and functional reach in PD patients [4,5]. In addition to conventional therapies for the gait and balance improvement in PD patients, such as auditory, visual, tactile (sensory/proprioceptive) or electromyography, cues have been used in contemporary studies [6–9].

In the present systematic review, cues will be characterized by an external mechanism that generates an increase in sensory and perceptual sensations to facilitate motor learning [10]. These devices have shown significant improvement in the balance, risk of falls [6], freezing, speed, and stride length [7] and a decrease in cadence [8].

To more broadly analyze these effects, Lim [11] conducted a systematic review, which noted that there were few studies with good methodological quality in between the years of 1999 and 2005, regarding the use of external cues to improve the gait in PD patients. This study concluded that the use of auditory cues had a greater influence on gait speed in this population than tactile and visual cues. At the end of the study, it was unclear whether these gains could have positive influences in daily life activities or decrease the risk of falls and freezing in PD patients. This study included randomized clinical trials, non-randomized studies and cross-sectional studies, which generated a large bias on the efficacy and effectiveness of treatment.

After the work of Lim, Spaulding [12] conducted another review about the improvement of the gait with the use of cues in PD. This study analyzed only analyzed articles published in the English language, and only included studies examining auditory and visual cues, ignoring the benefits of other types of cues. This author found that auditory cues were more effective for gait disorders in patients with PD, corroborating Lim's findings. At the end of the study, the author states that it was not possible to conclude which type of auditory cue is the best one to treat PD patients: "It should be emphasized that a wide variety of auditory cueing strategies were used in the research studies and that none cue was identified to have a more robust effect on gait improvement relative to the group of studies".

There are no other systematic reviews on the subject, although several studies have used distinct forms of cues for PD gait treatment.

We intended to evaluate the effectiveness and safety of cues on the gait of PD patients and how these cues could interfere with the

quality of life (QoL), psychomotor performance and freezing, and we sought to analyze which types of external cues would be the best for gait abnormalities.

## 2. Materials and methods

This review was submitted for the approval of the Ethics and Research Committee of the UNIFESP, Brazil before it was started and was based on the principles of the Cochrane Collaboration.

A systematic review of randomized clinical trials (RCTs) and quasi-randomized clinical trials (QRCTs), with two independent evaluators and a consensus meeting was conducted. The studies were searched in the period from March to August of 2013, using the Cochrane Library, PubMed, Lilacs, CINAHL, Pedro and Sumsearch databases. The references of the articles collected were analyzed, and a manual search on Movement Disorders, Physical Therapy and annals of the Movement Disorders Society was performed.

Studies were included if they provided the inclusion criteria, such as elderly people diagnosed with PD, female or male, walkers with or without aid, and on medication for PD. Studies were excluded if they analyzed other diseases, forms of Parkinsonism, compared healthy elderly patients with PD patients, or had different study design.

There were no time period or language limitations for the studies. The studies were RCTs and QRCTs that assessed the gait (step length, stride length, speed, cadence), freezing (*Freezing of Gait Questionnaire–FOGQ*), quality of life (*Parkinson's disease Questionnaire–PDQ-39*) and psychomotor performance (*Unified Parkinson's Disease Rating Scale–UPDRS*). If the study did not evaluate the gait, it was automatically excluded, but the other variables could be present or not be present in the data.

All of the studies should analyze the influence of cues (visual, auditory, somatosensory and/or cognitive) on gait parameters. To be included, the studies must compare two types of cues or compare one cue with another physiotherapy intervention or no intervention at all.

The evaluation methodology was based on the standards of the CONSORT Statement [13]. The criteria analyzed were: description of randomization; allocation of patients; comparison between the treatment groups; inclusion and exclusion criteria; blinding; and statistical analysis with intention to treat. To be considered as a RCT, the study should describe or refer to the process of randomization. When the data were inadequate, the author was contacted and the data were re-analyzed. If the randomization process was incorrect, the study was characterized as a QRCT.

In this analysis, the same two reviewers analyzed the risk of bias with a standardized table containing the following items: random sequence generation; allocation concealment; blinding of investigators; incomplete outcome data; selective reporting and other bias. All of the items were judged as adequate (low risk of bias), inadequate (high risk of bias) or unclear (high risk of bias).

Each database had an individual search strategy, but the same key words were used: Parkinson's disease, feedback, biofeedback, neurofeedback, psychology biofeedback, cue, cues, cueing, rehabilitation, physical therapy, physiotherapy, exercise, locomotion,

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