Biofeedback to improve the safety and efficiency of swallowing function in people with Parkinson’s Disease and dysphagia: A systematic review.

Background
Biofeedback as a rehabilitation technique is one approach that shows some promise clinically in people with dysphagia and PD. It is well recognised that the neural impairments in PD are manifested as reduced ability to plan motor acts based on internal cues and these could result in freezing and a coordination deficit during swallowing. In particular, sensory–perceptual deficits both prior to movement planning and during movement execution are important factors contributing to the impairments of motor coordination and movements execution. The effect of external feedback has already been demonstrated in physiotherapy and voice rehabilitation, suggesting that people with PD benefit from visual information more than other patient groups because visual feedback helps integrate different movement components by increasing the sensory motor information.

Aims
To conduct a systematic review on the efficacy and effectiveness of biofeedback treatment to improve swallowing function in adults with PD. A secondary objective was to evaluate its safety and identify adverse effects associated with this intervention in adults with PD.

Methods
A systematic review was planned and the protocol was published on PROSPERO 2017. All published and unpublished RCTs and non RCTs with no language restrictions were sought. Twelve databases (EMBASE, PubMed, CINAHL, Web of Science, Scopus, Science Direct, AMED, The Cochrane Database of Systematic Reviews, ProQuest Dissertations and Theses A & I, Google Scholar) were searched from inception to May 2017. Screening of titles was conducted using Covidence (www.covidence.org) by two review authors independently examined the data. Methodological quality of the included studies was assessed using Downs and Black checklist and Risk Of Bias In Non-randomized Studies – of Interventions (ROBINS-I) tool.

Results
Four studies with a total of 62 participants were included. Overall, methodological quality of the included studies was poor. Data was analysed descriptively. Despite the heterogeneity of the studies on type of biofeedback used, study design, outcome measures, and small sample sizes, visual biofeedbacks have positive effects on improving quality of life. Two types of visual swallowing biofeedback were selected: video-assisted swallowing therapy using fiberendoscopic and signal with surface electro-miography (SEMG).

Discussion and Conclusion:
This systematic review evaluated the efficacy, effectiveness and safety of biofeedback for the recovery of swallowing functions in PD persons. There was considerable heterogeneity within the included studies in terms of type of biofeedback, study design, outcome measures used with limitations of small sample sizes and no serious investigation of the long term effects of the interventions trialed. However, it is suggested that visual biofeedback cues are likely to be beneficial in swallowing rehabilitation treatment in PD with specific impact on improved quality of life for people with PD. In addition, patients at II** and III** stages of H&Y scale seem to benefit from a swallowing treatment using biofeedback.

Table 2: Summary of the selected studies

<table>
<thead>
<tr>
<th>Primary Author</th>
<th>Study Design</th>
<th>Objective</th>
<th>Study Duration</th>
<th>Participants</th>
<th>Disease Duration</th>
<th>Medication</th>
<th>Severity</th>
<th>Outcome measures</th>
<th>Comparator Group</th>
<th>Intervention Group</th>
<th>Swallowing Tasks</th>
<th>Methodological Quality</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alves da Silva et al. 2014</td>
<td>Case control study</td>
<td>Primary</td>
<td>15 therapy sessions, 3 times per week, 1 therapy session (1 per week)</td>
<td>6 (Males 73.1±6.2 yrs)</td>
<td>NA</td>
<td>NA</td>
<td>Borre</td>
<td>Oral facial, respiratory and voice exercises. Mendelian manoeuvres, effortless swallow</td>
<td>Biofeedback swallowing using SEMG</td>
<td>ROBINS: Severe Down and Black: 3/4 (Moderate quality)</td>
<td>Saliva swallows</td>
<td>Significant differences between groups, SWAL-QOL (p&lt;0.04)</td>
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<tr>
<td>Athukorala et al. 2014</td>
<td>Within Subject Study</td>
<td>Primary</td>
<td>10 therapy sessions over a 2-week period</td>
<td>10 (5 females, 5 males; 67.4±6.6 yrs)</td>
<td>6.6±4</td>
<td>On Phase (Cerebral/levedopa) H&amp;Y 2.7±0.4</td>
<td>TWST and TOMASS</td>
<td>Biofeedback Swallowing Skill Training (BSST)</td>
<td>Biofeedback using an air balloon placed in the anterior part of neck which was connected to a digital manometer</td>
<td>ROBINS: Moderate Down and Black: 3/4 (Moderate quality)</td>
<td>TWST (p&lt;0.05) TOMASS (p&lt;0.01)</td>
<td>Significant increase in pressure was observed for both the swallowing of saliva and the biscuit at the end of the rehabilitation program (p&lt;0.001)</td>
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<tr>
<td>Felix et al. 2008</td>
<td>Case series</td>
<td>Primary</td>
<td>14 therapy sessions for 2 week period</td>
<td>4 (1 females, 3 male, 70.25±10 yrs)</td>
<td>9.25</td>
<td>On Phase (Levedopa and Benserazide) H&amp;Y 3</td>
<td>Clinical swallowing assessment Conventional Therapy</td>
<td>Biofeedback swallowing treatment using videos of FEES examination</td>
<td>Biofeedback swallowing treatment using compensatory manoeuvres</td>
<td>No treatment</td>
<td>ROBINS: Low and Down: 1/2 (Excellent quality)</td>
<td>Differences among group: reduced food residues at FEES (p&lt;0.05) SWAL-QOL (p&lt;0.01) POE (p&lt;0.05)</td>
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<tr>
<td>Mancini et al. 2013</td>
<td>RCT</td>
<td>Primary</td>
<td>5 therapy sessions over a 2-week period</td>
<td>48 (18 females 24 males; 67.66±8.26 yrs)</td>
<td>7.4±0.6</td>
<td>H&amp;Y 2.1±0.79</td>
<td>FEES, SWAL-QOL, SWAL-CARE, POE</td>
<td>Biofeedback swallowing treatment using videos of FEES examination</td>
<td>Biofeedback swallowing using compensatory manoeuvres</td>
<td>No treatment</td>
<td>ROBINS: Low and Down: 1/2 (Excellent quality)</td>
<td>Differences among group: reduced food residues at FEES (p&lt;0.05) SWAL-QOL (p&lt;0.01) POE (p&lt;0.05)</td>
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References