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LITERATURE REVIEW

# Bladder training combined with other conservative therapies may be superior to bladder training alone for improving patient-reported symptoms in women with idiopathic overactive bladder

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## Abstract

Overactive bladder (OAB) symptoms can have a significant effect on quality of life, including participation in physical and social activities of daily living. A conservative therapy is defined as any intervention that does not involve surgery or pharmacology, and is internationally accepted as the first-line treatment for OAB. It is acknowledged that conservative therapies have a relatively low cost and minimal adverse events. Second-line treatment involves antimuscarinic drug therapy, but side effects such as dry mouth, headaches and constipation are common. Current guidance recommends that conservative strategies such as bladder training (BT) are combined with pharmacological therapy for the optimal management of OAB (Lightner *et al.* 2019). However, the efficacy of combining BT with other conservative therapies (e.g. pelvic floor muscle training, electromyographic biofeedback, electrical stimulation, and percutaneous and transcutaneous tibial nerve stimulation) remains uncertain. The focus of this literature review was to evaluate the existing evidence for the efficacy of BT combined with other forms of conservative treatment in comparison to BT alone on patient-reported symptoms in women with idiopathic OAB. A literature search covering the period from 2011 to 2021 was performed, and three relevant randomized controlled trials were identified. The findings suggest that BT combined with another conservative treatment is superior to BT alone for improving patient-reported symptoms of OAB. However, further research of high methodological quality is required to investigate the most clinically and cost-effective combination of conservative treatments.

*Keywords:* bladder training, conservative therapy, overactive bladder, physiotherapy.

## Introduction

Overactive bladder (OAB) is a common syndrome that is characterized by distressing urinary symptoms that significantly affect a woman's quality of life (QOL). The International Continence Society defines OAB as "[u]rinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence in the absence of urinary tract infection (UTI) or other obvious pathology" (Haylen *et al.* 2010, p. 6). Overactive bladder is a diagnosis of exclusion that is made once UTI and any other detectable disease are excluded. The reported prevalence is 17%, and this increases with age to 31% for women over 75 years (Milsom *et al.* 2001).

Bladder training (BT), which is also known as bladder drill, bladder retraining and bladder re-education, is a type of behavioural therapy that is based on the principles of operant conditioning (Booth & Bliss 2020). It is proposed that BT improves the cortical control of bladder function through patient education, structured voiding

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and positive reinforcement techniques (Booth & Bliss 2020). Bladder training is recognized as a safe and effective intervention that improves the symptoms of OAB in 57–87% of cases (Wyman 2003). It forms the mainstay of conservative treatment for OAB (Wallace *et al.* 2004), and is recommended as the first-line treatment across international guidelines (Gormley *et al.* 2012; NICE 2019; Harding *et al.* 2021). Specialist physiotherapists are well placed to offer supervision and coaching, which have been proven to optimize success (Dumoulin *et al.* 2017).

Pelvic floor muscle (PFM) training (PFMT) is defined as the "repetitive selective voluntary contraction and relaxation of specific pelvic floor muscles" (Abrams *et al.* 2002, p. 176), and is commonly incorporated with BT in clinical practice. Voluntary PFM contraction has been demonstrated to facilitate urge suppression by inhibiting detrusor contraction through the perineodetrusor inhibitory reflex (Shafik & Shafik 2003). Additionally, it is hypothesized that PFMT induces morphological changes to the PFMs that stabilize neurogenic activity and urethral pressure (Bø *et al.* 2020). Biofeedback (BFB) is a technique that provides visual, auditory or tactile feedback about a physiological process (e.g. PFM contraction) to a patient (Abrams *et al.* 2002). There is conflicting evidence supporting the use of PFMT assisted by electromyographic (EMG) BFB (EMG-BFB) for OAB (Voorham *et al.* 2017; Hagen *et al.* 2020).

Neuromodulation is commonly used in the management of OAB because it targets specific nerves in the sacral plexus that affect bladder and PFM function (Stewart *et al.* 2016). Neuromodulation with electrical stimulation (ES) can be delivered by percutaneous tibial nerve stimulation (PTNS), which involves non-implanted electrodes (e.g. vaginal or anal probes) and a needle, or by transcutaneous tibial nerve stimulation (TTNS), which uses transcutaneous electrodes. Such treatments have been proven to be safe and effective for the management of the symptoms of OAB, although it is yet to be established whether combining these modalities with BT improves patient-reported symptoms (Stewart *et al.* 2016; De Wall & Heesakkers 2017; Booth *et al.* 2018).

The role of pharmacological therapy in improving patient-reported symptoms of OAB is well established (Rai *et al.* 2012; Corcos *et al.* 2017). However, in an ageing population, it is common for comorbidities to limit the safety and appropriateness of pharmacological therapy for the management of a benign condition (Corcos *et al.* 2017). Additionally, many women are reluctant to pursue medication or cannot tolerate the side effects (Rai *et al.* 2012).

The conservative therapies outlined above act through different mechanisms, and therefore, it should be established whether combining these therapies with BT offers a cumulative effect that satisfactorily improves patient-reported symptoms. Therefore, the present literature review was conducted to answer the following question: is BT combined with other conservative therapies such as PFMT, EMG-BFB, ES, PTNS or TTNS superior to BT alone for improving patient-reported symptoms in women with idiopathic OAB?

## Materials and methods

A literature search was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Page *et al.* 2021). A population, intervention, comparator, outcome, study design and timeframe (PICOST) search strategy was identified that informed the inclusion criteria, and this is presented with the exclusion criteria in Table 1. An electronic database search was performed on 30 June 2021 using the search strategy and limits detailed in Table 2. A secondary search was conducted manually using the reference lists of relevant articles.

Three randomized controlled trials (RCTs) that met the eligibility criteria were identified for critical appraisal (Fig. 1). The methodological quality and risk of bias of the studies included was evaluated using published appraisal tools: the Physiotherapy Evidence Database (PEDro) scale (Maher *et al.* 2003; Cashin & McAuley 2020) (Table 3); and the Cochrane Collaboration's tool for assessing risk of bias (Higgins *et al.* 2011) (Table 4). All three studies (Kafri *et al.* 2013; Firinci *et al.* 2020; Sönmez *et al.* 2021) scored 6/10 on the PEDro scale, suggesting "good" methodological quality (PEDro 1999).

## Results

The three RCTs included compared BT alone to BT combined with either PFMT (Kafri *et al.* 2013), EMG-BFB and ES, (Firinci *et al.* 2020), or PTNS and TTNS (Sönmez *et al.* 2021). Therefore, these studies were considered appropriate for inclusion in the present literature review. Table 5 presents the characteristics of the RCTs.

**Table 1.** Inclusion and exclusion criteria

| Variable | Criteria |
|---|---|
| *Inclusion* | |
| Population | Adult women with symptoms of idiopathic overactive bladder |
| Intervention | Bladder training in addition to another conservative therapy (e.g. pelvic floor muscle training, electromyographic biofeedback, electrical stimulation, percutaneous tibial nerve stimulation and transcutaneous tibial nerve stimulation) |
| Control | Bladder training alone |
| Outcome | Patient-reported measure of urinary urgency, frequency, nocturia or urge urinary incontinence |
| Study design | Randomized controlled trials |
| Time | Published between 2011 and 2021 (inclusive) |
| *Exclusion* | |
| Population | Neurological diagnosis<br>Urinary tract infection not excluded<br>Post-void residual > 100 mL<br>Women with predominant stress urinary incontinence<br>Women within 3/12 of pelvic surgery |

**Table 2.** Search strategy: (CINAHL) Cumulative Index to Nursing and Allied Health Literature; and (MEDLINE) Medical Literature Analysis and Retrieval System Online

| Variable | Details |
|---|---|
| Databases | CINAHL, MEDLINE and Cochrane Library |
| Search terms: | |
| population | Overactive bladder; overactive bladder symptoms; OAB; urinary urge*; urge* urinary incontinence; urinary frequency; nocturia |
| intervention | Bladder training; bladder drill; bladder retraining; bladder re-education; conservative therap*; combination therap* |
| Search limits | English-language papers published between 2011 and 2021 (inclusive) |
| Additional search strategies | Hand search of reference lists |

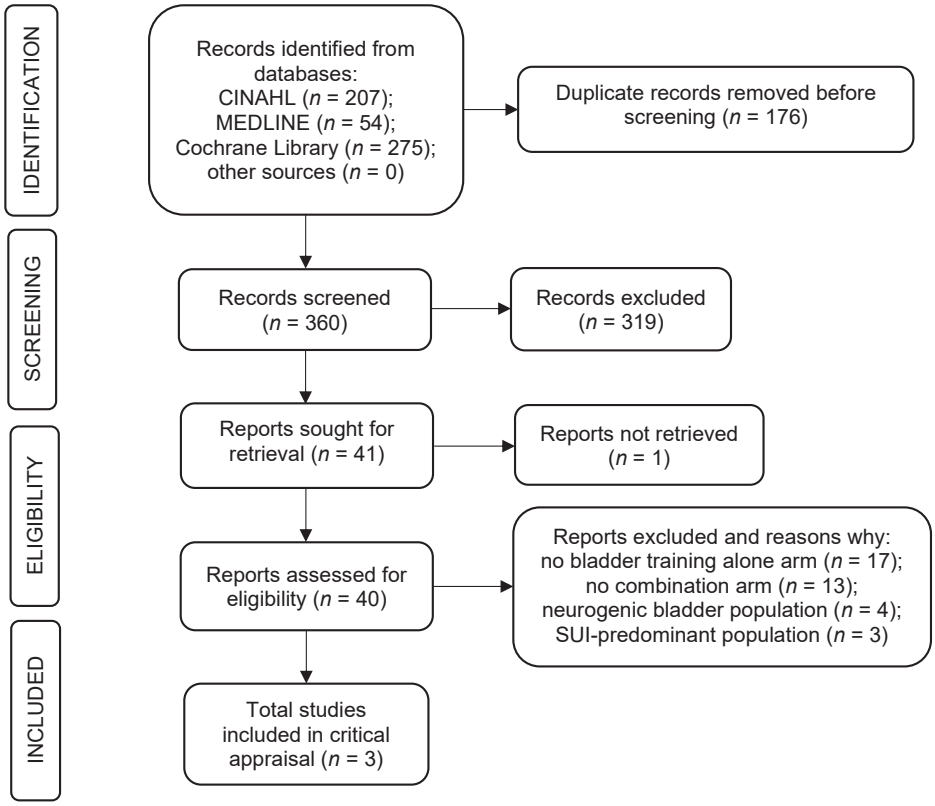


**Figure 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart demonstrating the literature search strategy (Moher *et al.* 2009; Page *et al.* 2021): (CINAHL) Cumulative Index to Nursing and Allied Health Literature; (MEDLINE) Medical Literature Analysis and Retrieval System Online; and (SUI) stress urinary incontinence

**Table 3.** Physiotherapy Evidence Database (PEDro) score of the studies included (PEDro 1999): (+) criterion met; and (–) criterion not met

| Variable | Reference | | |
|---|---|---|---|
| | Kafri *et al.* (2013) | Firinci *et al.* (2020) | Sönmez *et al.* (2021) |
| Eligibility criteria* | + | + | + |
| Random allocation | + | + | + |
| Concealed allocation | + | – | – |
| Baseline compatibility | + | + | + |
| Blinded subjects | – | – | – |
| Blinded therapist | – | – | – |
| Blinded assessors | + | + | + |
| Adequate follow-up > 85% | – | + | + |
| Intention-to-treat analysis | – | – | – |
| Between-group comparisons | + | + | + |
| Point estimates and variability | + | + | + |
| PEDro score | 6/10 | 6/10 | 6/10 |

*The eligibility criteria do not contribute to the total score.

**Table 4.** Risk of bias summary for each study included (Higgins *et al.* 2011): (+) low; (–) high; and (?) unclear

| Reference | Risk of bias item | | | | |
|---|---|---|---|---|---|
| | Selection bias | | Performance bias: blinding of participants and therapists | Detection bias: blinding of outcome assessment | Attrition bias: incomplete data |
| | Random sequence generation | Allocation concealment | | | |
| Kafri *et al.* (2013) | + | + | – | + | ? |
| Firinci *et al.* (2020) | + | ? | – | + | – |
| Sönmez *et al.* (2021) | + | ? | – | + | ? |

Patient-reported symptoms of OAB were evaluated using bladder diaries in all three RCTs. Two studies assessed the severity of the participants UUI with the 24-h pad test (Firinci *et al.* 2020; Sönmez *et al.* 2021). Additionally, Sönmez *et al.* (2021) assessed patient-reported symptom severity using the Overactive Bladder 8-Question Awareness Tool, which has been validated in Turkish (Tarcan *et al.* 2012).

All three RCTs reported statistically significant improvements in patient-reported OAB symptoms across all groups that were in favour of the combined conservative treatment arms when compared with BT alone (Kafri *et al.* 2013; Firinci *et al.* 2020; Sönmez *et al.* 2021).

Only Kafri *et al.* (2013) reported a clinically relevant improvement in voiding frequency, which was defined as a decrease from more than three voids every 24 h (Fitzgerald *et al.* 2005), and this was achieved in the BT + PFMT group. Kafri *et al.* (2013) included a follow-up period, and described statistically significant improvements in UUI that were maintained in both the BT alone and BT + PFMT groups at the 12-month follow-up.

Patient adherence was assessed in two studies, and was highest in combined intervention groups, with BT + TTNS attaining 100% adherence (Kafri *et al.* 2013; Sönmez *et al.* 2021). Additionally, Sönmez *et al.* (2021) reported that patient satisfaction was higher in the combined BT + TTNS and BT + PTNS groups compared to the BT alone arm.

No serious adverse events were reported in any of the interventions. Three patients reported vaginal irritation as a result of ES (Firinci *et al* 2020), and three reported ecchymosis at the site of TTNS application (Sönmez *et al.* 2021).

## Discussion

Bladder training is widely recommended as the first-line treatment for the management of patient-reported symptoms of OAB (Gormley *et al.* 2012; NICE 2019; Harding *et al.* 2021). However, women who do not report satisfactory improvements with BT are commonly offered medication, invasive investigations, Botox injections or surgery (NICE 2019). In a time of heighted scrutiny of medical interventions for benign conditions, there is a need to investigate the role that combined conservative therapies can play. These can improve patient choice and the QOL of women suffering from the symptoms of idiopathic OAB, and eliminate the need for escalation to an invasive intervention. The three RCTs discussed in the present literature review (Kafri *et al.* 2013; Firinci *et al.* 2020; Sönmez *et al.* 2021) support the hypothesis that BT in

**Table 5.** Characteristics of the studies included: (RCT) randomized controlled trial; (UUI) urge urinary incontinence; (BMI) body mass index; (OAB) overactive bladder; (PFM) pelvic floor muscle; (PFMT) pelvic floor muscle training; (BT) bladder training; (QOL) quality of life; (QOL-rUI) Quality of Life related to UUI questionnaire; (EMG-BFB) electromyographic biofeedback; (ES) electrical stimulation; (HEP) home exercise programme; (IIQ-7) Incontinence Impact Questionnaire, Short Form; (VAS) visual analogue scale; (PTNS) percutaneous tibial nerve stimulation; (TTNS) transcutaneous tibial nerve stimulation; and (OAB-V8) Overactive Bladder 8-Question Awareness Tool

| Reference | Country | Design | Population | Interventions in each group | Control | Outcome measures | Results |
|---|---|---|---|---|---|---|---|
| Kafri *et al.* (2013) | Israel | Four-arm RCT (1:1:1:1) | Women with more than three episodes of UUI in the 4 weeks prior to inclusion<br>$n = 164$<br>Mean age = 56.7 years<br>Mean BMI = 28.2 | Drug therapy:<br>women were provided with a 3-month supply of tolterodine (4 mg/day)<br>PFMT:<br>based on NICE (2019) guidelines<br>women practiced three sets of eight to 12 slow maximal contractions sustained for 6–8 s at each appointment, progressing from lying into standing<br>participants then continued daily PFMT independently at home, and were encouraged to complete PFM contractions as an urge deferment strategy<br>BT + PFMT:<br>all components of BT and PFMT interventions, and behavioural advice including bowel education, fluid modification and daily activity | BT:<br>aimed to increase voiding intervals with a predetermined or self-adjusted schedule comprised of patient education on bladder function, scheduled voiding and positive reinforcement<br>a frequency–volume chart was completed between appointments to record time and volume of voids per 24 h | Primary outcomes:<br>number of voids per 24 h, voided volume, UUI episodes and fluid intake, as recorded in the bladder diary<br>Secondary outcome:<br>QOL, as measured by the QOL-rUI at baseline, and the 3- and 12-month follow-ups | All four treatment groups showed significant improvements during the intervention period<br>A clinically relevant decrease in more than three voids per 24 h occurred only in the BT + PFMT group<br>A significant decrease in symptoms was found in the BT alone and BT + PFMT groups at the 3- and 12-month follow-ups<br>The limitation-disability component of the QOL-rUI showed a significant improvement for all three physical therapy groups, but not in the drug therapy group<br>Self-reported function related to improvement was only identified in the BT + PFMT group<br>The maximum bladder void was normal in all groups (325–420 mL), and there were no significant between-group differences<br>Adherence was highest in the BT + PFMT group (95%), and was significantly higher than in the drug therapy (64%) group ($P = 0.01$) at the 3-month follow-up |

*Continued/*

**Table 5.** (*Continued*)

| Reference | Country | Design | Population | Interventions in each group | Control | Outcome measures | Results |
|---|---|---|---|---|---|---|---|
| Firinci *et al.* (2020) | Turkey | Four-arm RCT (1:1:1:1) | Women with self-reported OAB symptoms referred to urogynaecology<br>$n = 70$<br>Mean age = 55.8 years<br>Mean BMI = 28.8 | BT + EMG-BFB:<br>EMG-BFB via a vaginal probe in addition to all components of BT<br>EMG-BFB for 20 min, three times a week, for 8 weeks<br>40 cycles of 10-s contractions followed by 20 s of relaxation<br>BT + ES:<br>intravaginal ES in addition to all components of BT<br>20 min, three times a week, for 8 weeks<br>frequency = 10 Hz, 5–10-s work–rest cycle and 100-ms pulse width<br>the intensity was controlled according to the patient's discomfort<br>BT + EMG-BFB + ES:<br>EMG-BFB, ES and all components of BT<br>EMG-BFB and ES were performed for 20 min each (total = 40 min) | BT:<br>all women were informed about BT for 30 min and received a brochure to be implemented as a HEP<br>BT consisted of four stages: PFM anatomy and pathophysiology; urgency suppression techniques; timed and progressive voiding intervals; and motivation to continue BT | Outcomes:<br>severity of incontinence measured by the 24-h pad test<br>PFM strength measured by perineometer in lithotomy<br>3-day bladder diary: voiding frequency, incontinence episodes, nocturia and number of pads<br>QOL measured with the IIQ-7<br>treatment satisfaction measured on a Likert scale (1–5)<br>treatment success assessed by the number of women with a > 50% reduction in incontinence episodes<br>cure and improvement rate measured by severity of incontinence using the 24-h pad test<br>level of discomfort during application rated on a VAS | A statistically significant improvement was found in all parameters for all groups at the end of the intervention compared to baseline ($P \leq 0.5$) except for PFM strength in the BT alone group<br>Severity of incontinence, frequency of voids, incontinence episodes and treatment satisfaction were significantly improved in the BT + ES and BT + EMG-BFB + ES groups compared with the other two arms<br>Significantly greater improvements were found for nocturia and QOL in the BT + EMG-BFB and BT + ES groups compared with the BT alone arm<br>Statistically significant improvements in nocturia and QOL were found in BT + EMG-BFB + ES group compared with the other three arms<br>There were no statistically significant differences in PFM strength, number of pads and level of discomfort during application between the four groups<br>Cure/improvement and positive response rates were significantly higher in the BT + ES and BT + EMG-BFB + ES groups compared with the BT alone and BT + BFB arms<br>No serious adverse events were reported, but temporary vaginal irritation was reported by three women in the BT + ES group |

*Continued/*

**Table 5.** (*Continued*)

| Reference | Country | Design | Population | Interventions in each group | Control | Outcome measures | Results |
|---|---|---|---|---|---|---|---|
| Sönmez *et al.* (2021) | Turkey | Three-arm RCT (1:1:1) | Women with self-reported OAB symptoms referred to urogynaecology<br>$n = 60$<br>Mean age: unknown<br>Mean BMI: unknown | BT + PTNS:<br>12 sessions of PTNS for 30 min for a total of 6 weeks<br>PTNS was applied unilaterally with 26-gauge stainless steel needles inserted 5 cm cephalad from the medial malleolus and posterior to the edge of the tibia<br>electrical stimulation was applied by using 200-μs pulses with a pulse rate of 20 Hz<br>the intensity level was chosen as the intensity immediately under the threshold that determined motor contraction<br>the stimulation amplitude was set at the maximal tolerable level according to the patient<br>BT + TTNS:<br>12 sessions of TTNS for 30 min for a total of 6 weeks<br>two self-adhesive surface electrodes were positioned with the negative electrode 2 cm behind the medial malleolus and the positive electrode 10 cm proximal<br>20 Hz and pulse width 200 μs in continuous mode in accordance with the PTNS protocol<br>the intensity of the stimulation (range = 0–50 mA) was determined according to the comfort level of the subject | BT:<br>all women were informed about BT for 30 min and received a written brochure to be implemented as a HEP<br>BT consisted of four stages: PFM anatomy and pathophysiology; urgency suppression techniques; timed and progressive voiding intervals; and motivation to continue BT | Primary outcome:<br>treatment success as measured by the percentage of positive responders (> 50% reduction in incontinence episodes)<br>Secondary outcomes:<br>severity of incontinence measured by 24-h pad test<br>3-day bladder diary: voiding frequency, incontinence episodes, nocturia and number of pads<br>symptom severity measured by the OAB-V8<br>QOL measured by the IIQ-7<br>treatment satisfaction measured with a Likert scale (1–5)<br>level of discomfort of application rated on a VAS<br>preparation time for stimulation (s)<br>measured at baseline and at 6 weeks | There was a statistically significant improvement in all variables for all groups at 6 weeks compared to baseline ($P = 0.0167$)<br>The BT + PTNS and BT + TTNS groups did not differ in terms of the variables at follow-up<br>Treatment success was greater in the BT + PTNS and BT + TTNS groups than in the BT alone arm ($P = 0.0001$)<br>Treatment satisfaction scores were higher in the BT + PTNS and BT + TTNS groups compared to the BT alone arm<br>Mean discomfort of application was significantly lower in the BT + TTNS group than the BT + PTNS arm ($P = 0.016$)<br>Mean preparation time was significantly shorter in the BT + TTNS group than the BT + PTNS arm ($P = 0.0001$)<br>Adherence was 95% in the BT alone and BT + PTNS groups, and 100% in the BT + TTNS arm<br>No serious adverse events were reported in any group except for temporary ecchymosis at the site of application in three patients in the BT + TTNS arm |

combination with another conservative therapy, such as PFMT, EMG-BFB, ES, TTNS or PTNS, is superior to BT alone. However, drawing definitive conclusions is problematic because of the small number of RCTs, heterogeneity between the studies and methodological quality.

All three RCTs compared BT combined with another conservative treatment to BT alone, and described statistically significant improvements in patient-reported OAB symptoms that were in favour of the combined intervention groups (Kafri *et al.* 2013; Firinci *et al.* 2020; Sönmez *et al.* 2021). There was heterogeneity across trials in the interventions that were combined with BT. Kafri *et al.* (2013) combined BT with PFMT, Firinci *et al.* (2020) combined BT with ES, EMG-BFB, and ES and EMG-BFB. Sönmez *et al.* (2021) combined BT with PTNS and TTNS.

Firinci *et al.* (2020) found a statistically significant improvement in nocturia and QOL in the BT + EMG-BFB + ES intervention, as compared with the BT + EMG-BFB, BT + ES and BT alone groups. However, participants in the triple intervention group had twice as much clinician contact time, which introduces the potential for performance bias because of the variation in treatment doses between the different arms (Firinci *et al.* 2020). Likewise, Sönmez *et al.* (2021) reported greater treatment success (> 50% reduction in incontinence episodes) and higher patient satisfaction in both the BT + TTNS and BT + PTNS groups. However, it is unknown whether additional clinician contact may have influenced the results. Furthermore, Kafri *et al.* (2013) reported that participants in the combined BT + PFMT arm received education on lifestyle choices related to bowel function, fluid intake, ergonomics and daily activity. Since this was not reported for either the BT or PFMT alone interventions, the potential for introduction of performance bias occurs again.

Sönmez *et al.* (2021) reported statistically significant treatment success in both the BT + PTNS and BT + TTNS groups compared to BT alone ($P = 0.0001$). Non-inferiority between the TTNS and PTNS groups when combined with BT was reported in a previous RCT (Ramírez-García *et al.* 2018). Both studies (Ramírez-García *et al* 2018; Sönmez *et al.* 2021) investigated TTNS as a clinician-led weekly or biweekly intervention; however, the ease of application of TTNS provides potential for home-based therapy. The optimal frequency of TTNS should be investigated further because increased patient-led home stimulation may lead to its superiority over PTNS.

The RCTs included in the present literature review described BT interventions in insufficient detail to allow optimal translation into clinical practice. A recent questionnaire evaluated the delivery of BT across international practice, and concluded that there was inconsistency and a lack of a standardized protocol in its implementation (Elnaggar *et al.* 2020). A current consensus statement by Booth & Bliss (2020) offers guidance, and identifies patient education, voiding interval progression using urge suppression strategies and positive reinforcement as the core components of BT. These core components were incorporated in all the studies included, despite inadequate detail being provided in relation to its application. To allow for standardization in clinical practice and research, the optimal frequency of supervision, delivery and length of BT interventions should be established.

The use of bladder diaries to assess patient-reported symptoms of OAB is accepted as the gold standard in clinical practice (NICE 2019). However, a lack of validation, poor compliance and patient burden limits the usefulness of bladder diaries in research (Chapple *et al.* 2016). Notwithstanding the heterogeneity of the outcomes used, all three RCTs included a QOL measurement, and two (Firinci *et al.* 2020; Sönmez *et al.* 2021) measured patient satisfaction, as recommended by Chapple *et al.* (2016), which proved higher in combined BT interventions.

The RCTs included in the present literature review did not include waiting-list controls with substantial follow-up periods, and thus, it is impossible to determine the true effect of each intervention compared to a natural history alone. However, a comparison between interventions was necessary in order to answer the research question and inform clinical practice. Additionally, a placebo effect of behavioural interventions in OAB cannot be ruled out, and the use of self-reported outcome measures may have amplified this potential (Mangera *et al.* 2011).

All three RCTs reported statistically significant treatment effects in favour of the combined interventions. However, only one reported a minimally clinically important difference in a primary outcome measure (Kafri *et al.* 2013), which raises the issue of possible reporting bias in the others (Firinci *et al.* 2020; Sönmez *et al.* 2021). *P*-values were provided in all three RCTs, but only Sönmez *et al.* (2021) published confidence intervals and, thus, were able to confirm the clinical significance of the reported treatment effect.

According to the PEDro scale, all the RCTs included were of "good" methodological quality; however, a high risk of bias was identified in each, which reduces the internal validity (Table 3). The nature of therapeutic interventions limits the feasibility of blinding participants and therapists; however, all three studies blinded outcome assessors, reducing the risk of detection bias. Two studies (Firinci *et al.* 2020; Sönmez *et al.* 2021) failed to describe concealed allocation, thereby introducing the potential for selection bias. Unfortunately, none of the RCTs provided clear evidence of an intention-to-treat analysis, meaning that there was a risk of attrition bias because of the potential for unequal losses of participants between groups. All three studies maintained a sample size required by their authors' power calculations, which reduced the risk of a type II statistical error.

The RCTs included in the present literature review were conducted in Israel and Turkey, where cultural and clinical practices differ considerably from the UK, which limits the applicability of the findings. The studies were performed in physiotherapy and urogynaecology clinics, but only the treatment doses described by Kafri *et al.* (2013) and Sönmez *et al.* (2021) could realistically be replicated within the UK National Health Service.

Regrettably, a cost analysis was not conducted, and therefore, the cost–benefit effectiveness of combined BT interventions remains ambiguous (Funada *et al.* 2020). Combined conservative interventions are likely to be time-consuming for both clinicians and patients, which may limit accessibility and adherence, particularly in rural settings and when face-to-face contact is restricted. Some research suggests that the use of apps (Wadensten *et al.* 2021) and home-based neuromodulation (Seth *et al.* 2018) may be effective for symptoms of idiopathic OAB, and these patient-led interventions should be investigated further.

## Limitations

The main limitation of the present literature review is that there was a failure to include more than one RCT for each combined intervention, which reflects the sparse literature on conservative combination therapies for OAB. Furthermore, the heterogeneity of the interventions, the subjectivity of the outcome measures and the poor details of the treatments limits our ability to draw firm conclusions about the implications for widespread clinical practice.

## Conclusions

Based on the current available evidence, the present authors conclude that interventions that include BT are safe and effective in treating the patient-reported symptoms of idiopathic OAB. There is some indication that interventions that combine BT with another conservative treatment are superior to BT alone when considering the effect upon patient-reported symptoms in women with idiopathic OAB. However, because of the small number and limitations of the RCTs included in the present literature review, conclusions about the effect of BT combined with PFMT, EMG-BFB, ES, TTNS or PTNS should be drawn with caution. Further research of high methodological quality should investigate the most clinically and cost-effective conservative treatment combinations in order to improve care, patient choice and QOL in women with idiopathic OAB.

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