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## Review – Incontinence

# Preoperative Pelvic Floor Muscle Exercise and Postprostatectomy Incontinence: A Systematic Review and Meta-analysis

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### Abstract

**Context:** Preoperative pelvic floor muscle exercise (PFME) is often prescribed to reduce the severity of postprostatectomy incontinence.

**Objective:** Systematic review and meta-analysis of evidence regarding the effect of preoperative PFME on postoperative urinary incontinence following radical prostatectomy.

**Evidence acquisition:** A systematic search was performed of the Cochrane Library, Medline, Embase, and all potential articles from references in relevant articles on 4 October 2014. We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement. Identified reports were critically appraised for quality and relevance. Only studies of preoperative PFME compared with no preoperative PFME were included.

**Evidence synthesis:** Eleven studies were included based on the selection criteria. The total number of patients included in the final analysis was 739. In seven studies, sufficient quantitative data on postoperative incontinence were available for meta-analysis. At 1 mo, there was no difference in continence rates between the groups (odds ratio [OR]: 0.68; 95% confidence interval [CI], 0.45–1.03). At 3 mo, there was 36% improvement in the preoperative PFME group (OR: 0.64; 95% CI, 0.47–0.88). At 6 mo, there was no difference between groups (OR: 0.60; 95% CI, 0.32–1.15). When examining quality of life measures, four of seven studies demonstrated significant improvement in the preoperative PFME group at 3 mo, and two of these studies demonstrated significant differences at 6 mo.

**Conclusions:** Preoperative PFME improves postoperative urinary incontinence after radical prostatectomy at 3 mo but not at 6 mo, suggesting it improves early continence but not long-term continence rates.

**Patient summary:** We reviewed all evidence for preoperative pelvic floor muscle exercise (PFME) in treating urinary incontinence following radical prostatectomy. We found evidence to suggest that preoperative PFME improves early continence rates but not long-term continence rates.

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## 1. Introduction

Urinary incontinence (UI) is one of the most common side effects of radical prostatectomy (RP) and can substantially affect a man's quality of life (QoL). The rates of UI vary with

the type of procedure or surgical technique [1]. Reported rates of UI after RP vary and depend on definition but have been reported up to 87% at 1 mo postoperatively [2]; however, UI generally improves by the 1-yr postoperative mark [3]. The cause of UI is considered to be multifactorial

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and the result of urethral sphincter deficiency or laxity and the destruction of support mechanisms through surgical injury; detrusor overactivity, impaired bladder sensation, and low bladder compliance can occur [4,5]. There are many preoperative, intraoperative, and postoperative interventions in current practice for the prevention and treatment of UI for after RP. One of these interventions is pelvic floor muscle exercise (PFME) with or without biofeedback. PFME is often guided by a physiotherapist and can be performed with or without biofeedback. Biofeedback may be given to the patient via auditory, tactile, or visual feedback of their pelvic muscle function.

A Cochrane Review evaluating postoperative PFME reported that the evidence is conflicting, and the value of

postoperative PFME following prostatectomy remains uncertain [6]. We aimed to determine the effectiveness of preoperative PFME for improving postoperative UI following RP.

## 2. Evidence acquisition

### 2.1. Search strategy

A systematic Medline, Embase, and Cochrane Library search was conducted 4 October 2014. The search strategy keywords used were selected to be as sensitive as possible; iterations and suggested terms were included and used if possible (Supplementary Table 1 and 2). Cited references

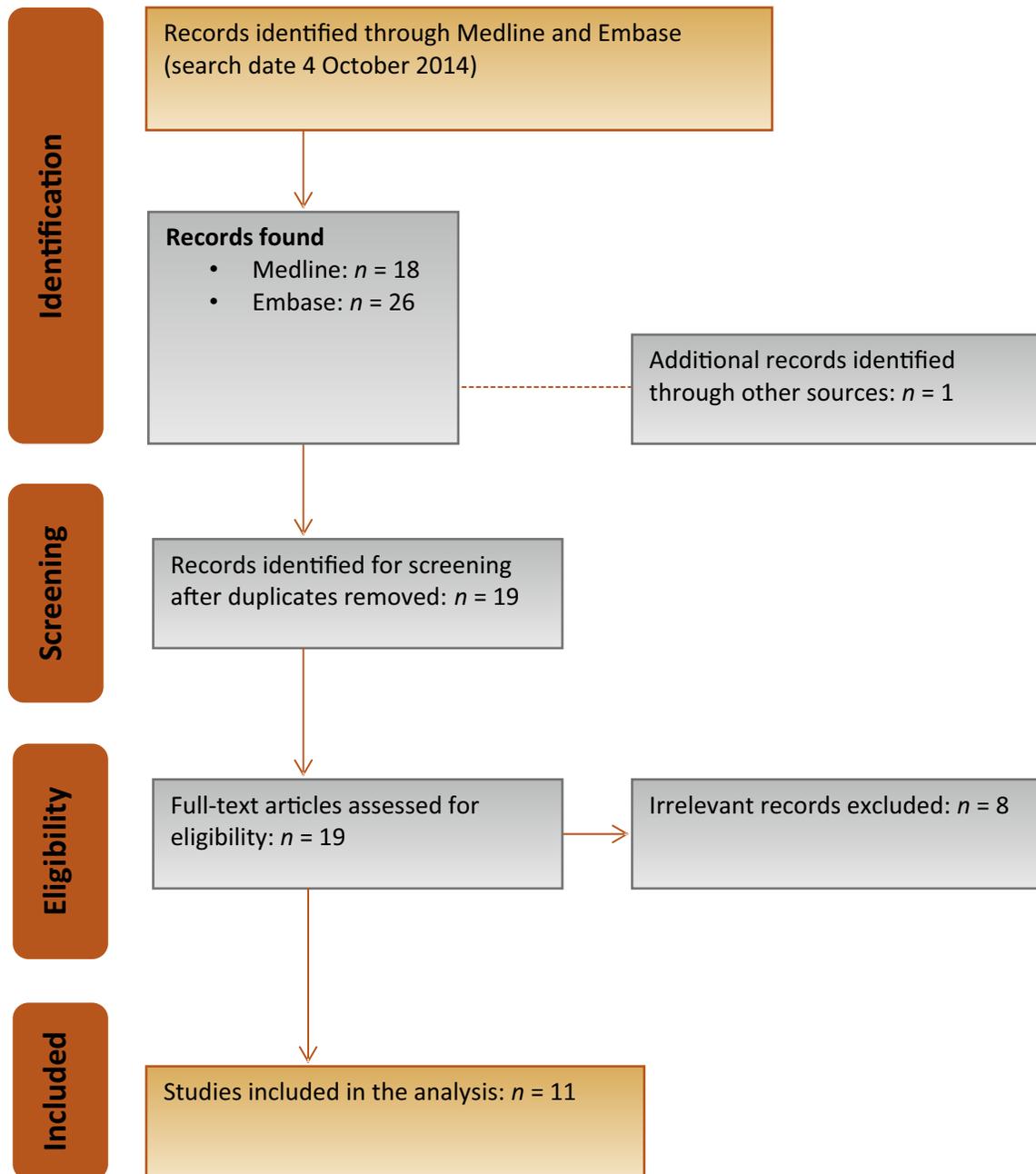


Fig. 1 – Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow chart.

**Table 1 – Study inclusion criteria**

<b>Types of radical prostatectomy</b>	Open, laparoscopic, robotic assisted
<b>Prostate cancer stage</b>	Lower than T3
<b>Types of study</b>	Prospective and retrospective
<b>Type of intervention</b>	Pelvic floor muscle training with or without biofeedback
<b>Timing of first PFME session</b>	Had to occur preoperatively
<b>Outcome measures</b>	Continence and QoL measures
PFME = pelvic floor muscle exercise; QoL = quality of life.	

from selected studies were also retrieved. A total of 44 articles were retrieved from the literature search. One related article that fit the selection criteria was also identified and added to the pool of articles for further review [7]. We then eliminated 34 articles (inclusive of 3 duplicates) by reading abstracts and the full articles, as necessary. Eleven articles were included in this systematic review [7–17] (Fig. 1).

### 2.2. Inclusion and exclusion criteria and outcome measures

Included studies focused on men of all ages undergoing RP. The inclusion criteria for selected articles are outlined in Table 1. The intervention had to involve a form of preoperative PFME with or without guidance (physiotherapist or nurse) and with or without biofeedback (auditory, visual, or tactile). Studies that did not have a comparator (no preoperative PFME) were excluded. Studies that were not published in the English language and that were editorials, commentaries, or review articles were also excluded.

The main outcome measures were continence rates, 24-h pad weight, and standardised QoL measures (American Urological Association Symptom Index, King's Health Questionnaire [KHQ], University of California Los Angeles Prostate Cancer Index [UCLA-PCI], International Consultation on Incontinence Questionnaire [ICIQ], International Prostate Symptom Score [IPSS]).

### 2.3. Data collection and analysis

We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) process [18] for reporting both included and excluded studies, with the recommended flow chart showing numbers of papers identified and included or excluded at each stage (Fig. 1). Titles and abstracts were reviewed for relevance to the defined review question. If it was not clear from the abstract whether the paper might contain relevant data, the full paper was assessed. References cited in full-text articles were also assessed for relevant articles. The search was carried out by two reviewers (J.I.C. and M.I.P), and discrepancies were resolved by discussion. Articles of interest were tabulated, and meta-analysis was performed by V.L.

Seven studies [7,8,10,13–15,17] contained sufficient quantitative data on postoperative incontinence suitable for meta-analysis. To synthesise the results, we compared the intervention of preoperative PFME with the standard of no preoperative PFME prior to RP. UI at 1, 3, and 6 mo was

analysed using the random-effects methods of DerSimonian and Laird [19]. We expressed results as odds ratios (ORs) for incontinence, with values <1 favouring continence.

## 3. Evidence synthesis

### 3.1. Included trials

We included 11 studies in this systematic review; however, only 7 studies [7,8,10,13–15,17] had sufficient quantitative data on postoperative incontinence available for meta-analysis. Table 2 depicts the characteristics of the studies included. The data on this topic are quite recent because more than half of these studies were published in the past 5 yr.

### 3.2. Quality of included trials

We assessed the risk of bias for each study as per the guidelines of the Cochrane handbook [20] (Table 3). Of the 11 papers selected, all but 1 study [7] were prospective trials. Of these 10 trials [8–17], 9 were randomised controlled trials; however, 3 trials [8,11,15] did not describe how patients were randomised. Of the 11 papers, only 3 had both surgeons and assessors blinded [9,14,17]. In the study by Centemero et al [10], only the surgeon was blinded. In two studies [12,13], only the physiotherapists were mentioned as blinded. Most studies did not mention blinding or were nonblinded [7,8,11,15,16].

Most papers mentioned and explained the reasons for dropouts [7–11,13,14,17]. Only Dijkstra-Eshuis et al did not explain the reason for incomplete data [12]. Two studies did not mention any dropouts [15,16].

All trials excluded men who had incontinence preoperatively, except for one study that included men with UI as evident in the preoperative incontinent results [14] and one study that did not mention this issue [16].

### 3.3. Definition of continence

There was no consensus on the definition of continence. Some studies incorporated more than one method of defining continence. Two studies [8,15] defined continence as one pad or fewer used per day. Four studies used weight of pads at specified timed intervals as the definition of continence; two studies [13,14] used <1 g at 1 h and the other two [7,12] used <2 g at 24 h as the definition of continence. Three studies [10,12,17] based the definition on patients' self-reporting and continence questionnaires. Burgio et al [9] used their own definition of three consecutive weekly 1-d diaries with no leakage or 7 d with no leakage. Two studies [11,16] did not describe the definition of urinary continence.

There was heterogeneity among the QoL tools used, which included the ICIQ–Urinary Incontinence (ICIQ–UI), the ICIQ–Overactive Bladder (ICIQ–OAB), the UCLA–PCI, the IPSS, visual analogue scales, the KHQ, Pelvic Floor Inventories Leiden, Hopkins symptoms checklist, and a medical outcomes study short form. Some studies used a combination of these QoL

**Table 2 – Characteristics of trials included in the review**

Study	Year	Definition of continence	Pelvic floor muscle training regimen	Length and timing of preoperative PFME	Outcomes measurements	Length of follow-up, mo
Patel et al [7]	2013	<2 g on 24-h pad weight test	Physiotherapist guided, verbal and visual feedback	First session $\geq$ 4 wk preoperatively	Pads per day or week or 24-h pad test weight	3
Geraerts et al [14]	2013	Urine loss of < 1g at 1 h	Physiotherapist guided, visual feedback, digital palpation and EMG rectal probes	First session 2–4 wk preoperatively	Objective measurements and questionnaires	12
Collado et al [11]	2013	Not defined	Surface electrode, incorporates abdominal hypopressive techniques	First session 2–4 wk preoperatively	Objective measurements and questionnaires	12
Dijkstra-Eshuis et al [12]	2013	<2 g on 24-h pad weight test, based on self-reports and continence questionnaire	Physiotherapist guided, visual feedback, digital palpation and EMG rectal probes	First session 2–4 wk preoperatively	Objective measurements and questionnaires	12
Tienforti et al [17]	2012	Based on self-reports and continence questionnaire	Physiotherapist guided, verbal and visual feedback	First session 1 d preoperatively	ICIQ, KHQ, IPSS, PGI, VAS, UCLA-PCI, or self-reported continence rates	$\leq$ 6
Centemero et al [10]	2010	Based on self-reports and continence questionnaire	Physiotherapist guided, verbal and visual feedback	First session 2–4 wk preoperatively	ICIQ, KHQ, IPSS, PGI, VAS, UCLA-PCI, or self-reported continence rates	3
Dubbelman et al [13]	2010	Urine loss of <1 g at 1 h	Physiotherapist guided, verbal and visual feedback	First session 1 d preoperatively	Pads per day or week or 24-h pad test weight	$\leq$ 6
Burgio et al [9]	2006	3 consecutive weekly 1-d diaries with no leakage or 7 d with no leakage	Visual biofeedback and rectal probes	1–3 sessions preoperatively, not stated when	ICIQ, KHQ, IPSS, PGI, VAS, UCLA-PCI, or self-reported continence rates	$\leq$ 6
Parekh et al [15]	2003	$\leq$ 1 pad per day	Physiotherapist guided, visual feedback, digital palpation and EMG rectal probes	1–3 sessions preoperatively, not stated when	Pads per day or week or 24-h pad test weight	12
Sueppel et al [16]	2001	Not defined	Visual feedback and rectal probes	2 sessions, “several weeks” preoperatively	Objective measurements and questionnaires	12
Bales et al [8]	2000	$\leq$ 1 pad per day	Nurse guided, surface electrode	First session 2–4 wk preoperatively	Pads per day or week or 24-h pad test weight	$\leq$ 6

EMG = electromyography; ICIQ = International Consultation on Incontinence Questionnaire; IPSS = International Prostate Symptom Score; KHQ = King's Health Questionnaire; PFME = pelvic floor muscle exercise; UCLA-PCI = University of California Los Angeles Prostate Cancer Index; VAS = visual analogue scale.

tools [9,12,14,17]. Other studies used a single QoL tool, although there was no consensus on a preferred tool [10,11,16].

### 3.4. Pelvic floor muscle exercise regimen

There was a variety of different pelvic floor muscle training regimens with or without biofeedback. There were also differences in the amount of detail with which the regimens were described in each study. The exercise regimens are summarised in Table 2.

A range of terms were used for timing of the first preoperative PFME session. In addition, there was variation in the number of sessions patients received before the operation. Most studies carried out the first session 2–4 wk prior to the operation [8,10–12,14]. Only Patel et al [7] started at least 4 wk preoperatively. At the other extreme,

two studies had their first session 1 d preoperatively [13,17]. The remaining studies did not clearly state the timing of the first PFME session.

The PFME sessions ranged from 20 min to 1 h in length and from twice a week to weekly in frequency.

### 3.5. Continence outcomes

In this meta-analysis, we found that there were significantly lower rates of postoperative incontinence at 3 mo in the preoperative PFME group compared with the control group, with an OR of being incontinent of 0.64 ( $p = 0.005$ ). There was no significant difference in postoperative incontinence rates at 1 mo (OR: 0.68;  $p = 0.07$ ) or 6 mo (OR: 0.60;  $p = 0.12$ ) (Fig. 2).

Seven studies measured secondary outcomes with QoL tools [9–12,14,16,17]. Four studies [10,11,14,17] showed

**Table 3 – Risk of bias summary: review authors’ judgments about each risk-of-bias item for the included studies**

Study	Year	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)
Collado et al [11]	2013	?	?	+
Dijkstra-Eshuis et al [12]	2013	+	-	?
Geraerts et al [14]	2013	+	+	+
Patel et al [7]	2013	NA	?	+
Tienforti et al [17]	2012	+	+	+
Centemero et al [10]	2010	+	-	+
Dubbelman et al [13]	2010	+	?	+
Burgio et al [9]	2006	+	+	+
Parekh et al [15]	2003	?	?	?
Sueppel et al [16]	2001	?	?	?
Bales et al [8]	2000	?	?	+

NA = not applicable.

statistically significant improvements with PFME at 3 mo. In the study by Centemero et al [10], there were significant differences in score on the International Continence Society male short form at 3 mo (8.1 vs 12.2 for intervention and control, respectively;  $p = 0.002$ ). Tienforti et al [17] found differences in scores at 3 mo on the UCLA-PCI (403.81 vs 272.44;  $p = 0.006$ ) and the ICIQ-OAB (10.12 vs 13.19;  $p = 0.04$ ). The study by Geraerts et al [14] showed significant difference in favour of the intervention group for KHQ score for incontinence impact at 3 mo ( $p = 0.008$ ). The study by Collado et al [11] showed differences on the ICIQ-UI short form (9.2 vs 12.1) at 3 mo, with a  $p$  value of 0.008. Only two studies reported differences in KHQ, UCLA-PCI, and ICIQ-OAB scores at 6 mo [14,17]. Tienforti et al [17] showed significant difference at 6 mo for scores on the UCLA-PCI

(422.5 vs 274.25;  $p = 0.003$ ) and the ICIQ-OAB (9.06 vs 12.62;  $p = 0.01$ ) in favour of preoperative PFME. Geraerts et al [14] showed better KHQ score for incontinence impact at 6 mo, with a  $p$  value of 0.024.

**3.6. Discussion**

**3.6.1. Summary of findings**

The meta-analysis demonstrated a significant 36% reduced risk of postoperative incontinence at 3 mo after RP if preoperative PFME was undertaken. Preoperative PFME, however, did not make a significant difference at 1 mo and 6 mo. This suggests that preoperative PFME may help early continence recovery but may not influence long-term incontinence rates beyond 6 mo. This is supported by the literature, as >90% of patients recover urinary continence in the long term [21,22]. Preoperative PFME could be potentially beneficial at 1 mo following operation; however, because only four studies (417 men) measured this outcome in this meta-analysis, it may well be underpowered.

UI after RP is multifactorial. Essentially, two anatomic systems maintain continence in men: the sphincteric system and a supportive system [23]. The sphincteric system is composed of an inner smooth muscle and a striated rhabdosphincter that contribute to the maintenance of urethral closure pressure. The interactions of the rhabdosphincter and the pelvic floor are interrelated but are not well understood in men [24]. Muscle fibres and innervation of the sphincter can be damaged as a result of surgery. The supportive system in the male patient includes Denonvilliers fascia, puboprostatic ligament, endopelvic fascia, levator ani muscles, and arcus tendineus fascia [23]. Although they may not be important in healthy men, after prostate removal, they become essential and may be compromised at the time of surgery.

The theoretical basis of PFME is that repeated volitional contraction of selected pelvic floor muscles may improve their strength and efficiency [25]. How PFME improves postoperative incontinence in men has not been fully elucidated; it may well improve the sphincteric mechanism through enhancing rhabdosphincter function and/or the supportive system thorough its effect on levator ani. The multifactorial aetiology of incontinence after RP can explain the varied results of PFME on an individual basis and in reported studies [25], as PFME will not correct all possible causes of postsurgery UI.

Current published literature on preoperative PFME is conflicting. Six studies suggested benefit [7,9,10,15–17], whereas five studies failed to demonstrate benefit [8,11–14]. All of the studies had small numbers of patients; therefore, in this study, with the aid of meta-analysis, we have shown the benefit of preoperative PFME.

Although our results show definite benefit with preoperative PFME regarding post-RP incontinence, Campbell et al concluded in a Cochrane Review [6] that there is still controversy about whether postoperative PFME is effective for urinary continence following operation. In total, only 2 of the 21 studies from the Cochrane Review show that postoperative PFME has a statistically significant benefit

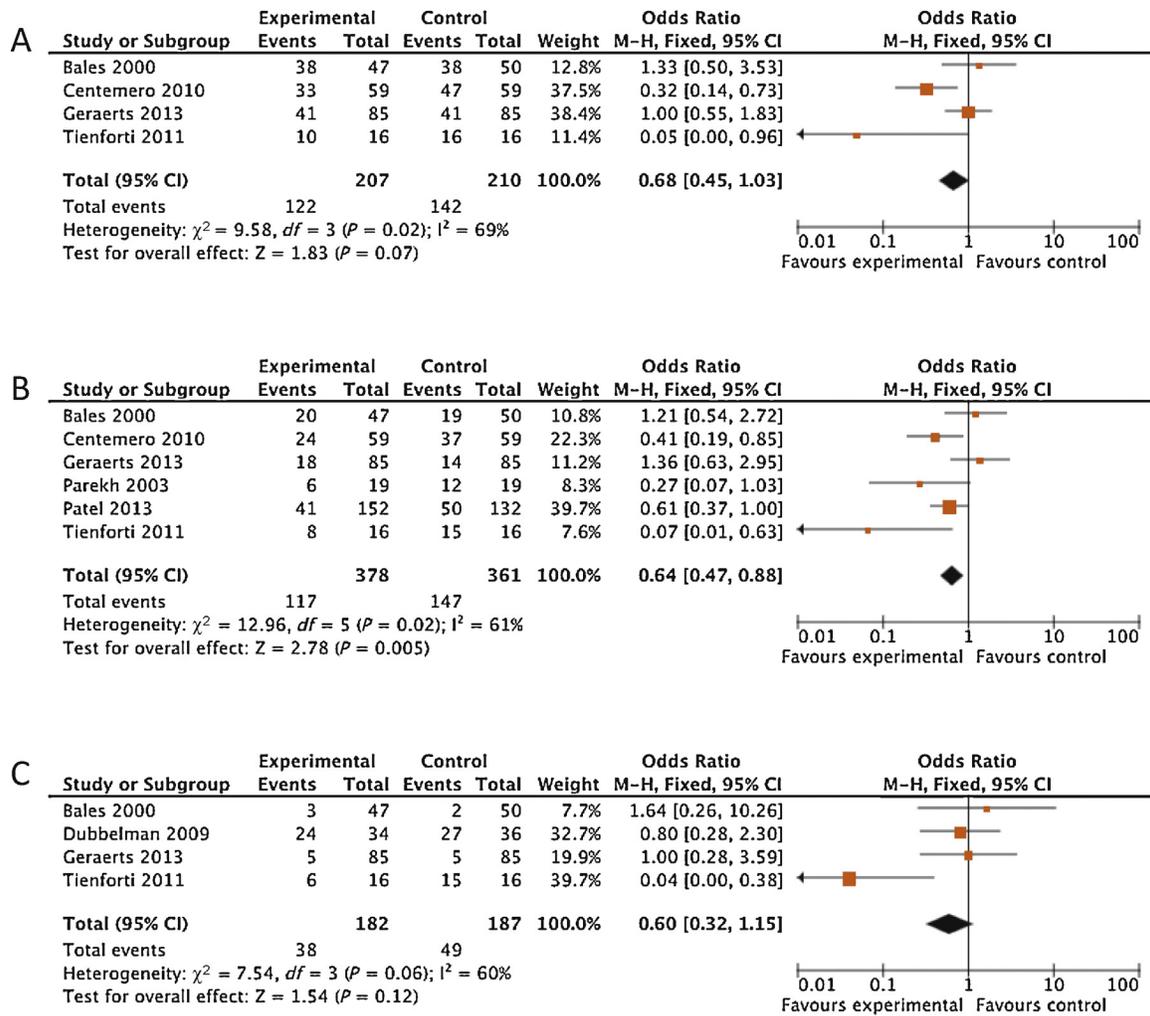


Fig. 2 – Forest plot of odds ratios for urinary incontinence with preoperative pelvic floor muscle exercise (PFME) compared with no preoperative PFME at (A) 1 mo, (B) 3 mo, and (C) 6 mo following radical prostatectomy. CI = confidence interval; M-H = Mantel-Haenszel.

aiding urinary continence recovery [26,27]. In the study by Manassero et al [26], UI rates were higher in the control group compared with the intervention group during follow-up at 1 mo (83.3% vs 97.5%;  $p = 0.04$ ), 3 mo (53.7% vs 77.5%;  $p = 0.03$ ), 6 mo (33.3% vs 60%;  $p = 0.01$ ), and 1 yr (16.6% vs 52.5%;  $p \leq 0.01$ ). Van Kampen et al [27] showed similar outcomes with lower risk ratios for patients with UI at <3 mo (0.24; 95% CI, 0.10–0.57), 3–6 mo (0.18; 95% CI, 0.04–0.77), and 6–12 mo (0.23; 95% CI, 0.05–1). They concluded that there was not enough evidence to say whether postoperative PFME was effective treatment for UI after RP. The effectiveness of pre- versus postoperative PFME might be due to the timing of PFME. Preoperative PFME prior to RP allows men to learn to control their pelvic floor muscles earlier and the sensations normally associated with these actions. This is thought to allow them to regain earlier urinary continence. Consequently, the difference could be due to the timing and “priming” of pelvic floor muscles and the mind-set of these men prior to prostatectomy.

3.6.2. Limitations

This study is limited by the small number of studies and patients that were available for analysis. Larger numbers and sizes of studies would have made the results more robust and less likely to be influenced by future studies. The study is also limited by the heterogeneity of the studies included. All studies had different regimens of PFME, definitions of continence, and QoL tools used. Follow-up periods tended to be short, as more than half of the studies concluded follow-up after 6 mo. The small numbers of patients in these studies may limit the difference at 1 and 6 mo in our meta-analysis. The quality of the individual studies was also diverse, which would have affected our meta-analysis.

4. Conclusions

Based on this systematic review and meta-analysis, preoperative PFME may aid early UI recovery and increase the QoL of patients after RP.

**Author contributions:** Manish I. Patel had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Study concept and design:* Patel.

*Acquisition of data:* Chang.

*Analysis and interpretation of data:* Patel, Lam, Chang.

*Drafting of the manuscript:* Patel, Chang.

*Critical revision of the manuscript for important intellectual content:* Patel, Lam, Chang.

*Statistical analysis:* Lam.

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*Administrative, technical, or material support:* Chang.

*Supervision:* Patel, Lam.

*Other (specify):* None.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.eururo.2015.11.004>.

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