

Research article

The role of Kegel exercises in reducing involuntary loss of urine in Overactive Bladder and Mixed Urinary Incontinence

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Abstract: This study aimed to evaluate the efficacy of Kegel exercises, or pelvic floor muscle training (PFMT), in reducing symptoms of urinary incontinence among women with overactive bladder (OAB) and mixed urinary incontinence (MUI). A randomized control trial was conducted with a total of 50 participants (young women ages 18-35) out of which 35 were diagnosed with OAB and 15 with MUI. The participants were monitored for six months: In the first three months received only pharmacological therapy, solifenacin succinate 10 mg per day, and after this period the same group associated to the pharmacological treatment daily Kegel exercises. The primary outcome measured was the reduction in urinary incontinence episodes, while secondary outcomes included changes in quality of life (QoL) and bladder control as assessed by standardized questionnaires. After three months, group demonstrated a reduction in the frequency of urinary incontinence episodes. However, receiving both solifenacin succinate and Kegel exercises showed a statistically significant improvement in urinary control and QoL scores at six months evaluation. These findings suggest that the combination of pharmacological treatment with solifenacin succinate and Kegel exercises is more effective in managing urinary incontinence symptoms associated with OAB and MUI than pharmacological treatment alone. This approach may represent a beneficial strategy for patients requiring enhanced symptom relief.

Keywords: Kegel exercises, urinary incontinence, overactive bladder

1. Introduction

Urinary incontinence, particularly urge incontinence associated with Urinary incontinence, particularly urge incontinence associated with overactive bladder (OAB), presents a significant challenge for millions of individuals globally, impacting their quality of life and psychological well-being. Urge incontinence is characterized by involuntary urine loss triggered by a sudden and overwhelming need to urinate, often leading to distressing situations where individuals struggle to reach a restroom in time. This condition differs fundamentally from stress urinary incontinence (SUI), where leakage occurs during physical exertion, such as coughing or sneezing. However, it is not uncommon for individuals to experience both forms of incontinence simultaneously, resulting in a mixed urinary incontinence scenario that complicates management strategies [1, 2, 3].

The incidence of overactive bladder is substantial, with approximately 34 million adults in the United States affected. The economic burden of managing this condition is staggering, costing billions annually. Beyond the financial implications, the psychosocial impact of urinary incontinence cannot be overstated. Individuals often

experience embarrassment, isolation, and reduced social engagement, leading to a diminished quality of life. As the population ages, the prevalence and consequences of urinary incontinence are expected to rise, emphasizing the urgency for effective interventions [4, 5, 6].

Central to the management of urge incontinence is the understanding of detrusor muscle function. The detrusor, the bladder's muscle wall, plays a critical role in urine storage and voiding. Its ability to contract and relax appropriately is essential for maintaining continence and ensuring effective bladder emptying. Detrusor instability, characterized by involuntary contractions during the bladder's filling phase, is a hallmark of overactive bladder and a primary contributor to urge incontinence [1, 4, 7].

In response to these challenges, Kegel exercises—also known as pelvic floor muscle training (PFMT)—have emerged as a cornerstone in managing urinary incontinence. These exercises focus on strengthening the pelvic floor muscles, which support key pelvic organs, including the bladder and uterus. Research indicates that Kegel exercises not only enhance bladder control and reduce the incidence of urinary leakage but also contribute positively to sexual function and overall pelvic health. Their efficacy spans various forms of incontinence, including both stress and urge types, underscoring the importance of integrating Kegel exercises into clinical practice for individuals suffering from urinary dysfunction [8, 9, 10, 11, 12].

As we delve deeper into the mechanisms underlying urinary incontinence and the impact of pelvic floor muscle training, it becomes evident that these interventions are essential not only for restoring physical function but also for enhancing the overall well-being of affected individuals. [13, 14]

2. Materials and Methods

The study involved 50 young female patients diagnosed with urinary incontinence related to OAB. Of these, 35 patients had OAB - OAB-associated urinary incontinence, while 15 presented with mixed urinary incontinence (MUI).

All the patients received a daily dose of solifenacin succinate, 10 mg (one tablet per day) for three months, and after this period solifenacin succinate 10 mg per day associated with Kegel exercises for the other three months. The exercises were performed twice daily, each session lasting 15 minutes and involving a cycle of contraction and relaxation of the pelvic floor muscles, with each contraction and relaxation phase lasting for 5 seconds.

All participants completed a urinary incontinence assessment questionnaire (Fig.1) at baseline, after three months and respectively after a six-month treatment period. This questionnaire evaluated both the frequency and severity of incontinence episodes, along with impacts on daily life.

Urinary Incontinence Assessment Sheet

Name _____ Allergies _____
 Date of Birth _____ Date of Visit _____
 Reviewed by _____

Not at All	Less than 1 time in 5	Less than 1/2 the time	About 1/2 the time	More than 1/2 the time	Almost Always	Your Score
0	1	2	3	4	5	
Urinary <u>Stress</u> Incontinence Over the past month, how often have you experienced an involuntary loss of urine when you have coughed, sneezed or changed position?						
0	1	2	3	4	5	
Urinary <u>Urgency</u> Incontinence Over the past month, how often have you had an involuntary loss of urine when you had a sudden urge to urinate?						

If you have experienced an involuntary loss of urine, please answer the following questions.

When did you first experience urinary incontinence? _____

Do you use pads to control your urinary leakage? No ___ Yes ___ (type _____, # of pads daily __; damp ___ soaked ___)

If you have both stress and urgency urinary incontinence, which type bothers you the most? Stress ___ Urgency ___

Have you experienced any skin irritation as a result of urinary incontinence? No ___ Yes ___

Diet and Lifestyle:

1. How much fluid (ounces) do you drink in 24 hours? _____

2. What type of fluid do you drink? _____

3. Have you ever smoked, or are you currently smoking? Never ___ No ___ (quit ___) Yes ___ (pk/day __, yrs smoking __)

4. If you have gained weight, have your symptoms worsened since you gained weight? No ___ Yes ___

Past history:

Have you given birth? No ___ Yes ___ (# children __/ type of delivery: vaginal ___ cesarean ___)

Do you have a constipation problem? No ___ Yes ___

Have you ever had any surgery to correct urinary leakage? No ___ Yes ___ (explain _____)

Have you taken any medications to treat urinary leakage? No ___ Yes ___ (explain _____) Have the medications helped? No ___ Yes ___

Have you ever had a urinary tract infection? No ___ Yes ___ (how often? _____)

Have you tried any other treatments to improve urinary control? No ___ Yes ___ (explain _____)

QUALITY OF LIFE DUE TO URINARY INCONTINENCE

Very Pleased	Pleased	Mostly Satisfied	Mixed	Mostly Dissatisfied	Unhappy	Terrible

If you were to spend the rest of your life with your urinary incontinence just the way it is now, how would you feel about it?

Figure 1. Urinary incontinence Assessment Questionnaire (<https://www.auanet.org>)

Exclusion Criteria: Participants were excluded if they were pregnant, had a renal or urinary infection in the past four weeks, had diabetes mellitus, genital prolapse, a history of prior incontinence surgery, psychiatric disorders, mobility issues, genitourinary fistula, permanent catheterization, or an inability to effectively contract pelvic muscles.

The study aimed to observe the benefits of Kegel exercises combined with solifenacin succinate in educating patients about managing OAB and addressing mixed incontinence with minor changes in the vesicourethral junction. Patients were instructed on the correct technique for performing Kegel exercises. During the first month, the exercises involved contracting the pelvic muscles for 3 seconds, followed by a 3-second relaxation period. Patients performed these exercises in a supine position with their thighs flexed at a 90-degree angle to the abdomen. Each session lasted 15 minutes and was conducted every 12 hours. In the second and third months, both the contraction and relaxation periods were extended to 5 seconds. All patients had a history of exclusive vaginal deliveries, with a maximum parity of three (multiparous), and their ages ranged from 18 to 35 years. The breakdown of patients by parity included 26 primiparous, 18 secundiparous, and 6 tertiparous individuals. The initial severity ratings indicated mild to moderate symptoms. Incontinence forms were classified into mixed incontinence and OAB and further divided by severity. Mixed incontinence was classified as moderate severity, while OAB exhibited three severity levels: mild, moderate, and severe. The inclusion criteria for mixed incontinence involved measuring the vesicourethral junction angle at greater than 100 degrees and experiencing involuntary urine loss during exertion, such as sneezing or coughing.

3. Results

The results presented in Table 1 demonstrate the clinical outcomes observed after 3 months of therapy with solifenacin 10 mg per day, while Table 2 highlights the enhanced effects achieved after 6 months of therapy, including a 3-month combination of Kegel exercises with solifenacin 10 mg per day.

	Complete Remission	Significant Improvement	Mild Improvement	Slight Improvement	No results	Quality of life	Quality of sexual life
Therapy in the group with mixed urinary incontinence (15 patients)	5 patients (33%) experienced complete remission of symptoms	4 patients (26,6%) reported a notable improvement in urinary symptoms, although they experienced occasional episodes of involuntary urine loss	2 patients (13,3%) showed slight amelioration of their symptoms	-	5 patients (33%) presented the same symptoms	6 patients (40%) reported an improvement	8 patients (53,33%) reported an improvement
In the group of patients with overactive bladder experiencing mild forms (27 patients)	10 patients (37%) reported a total remission of symptoms.	5 patients (18,5%) reported a notable improvement in urinary symptoms, although they experienced occasional episodes of involuntary urine loss	8 patients (29,6%) experienced a mild improvement in their symptoms	4 patients (14,8%) noted minor benefits regarding their symptoms. Notably, all 4 of these patients exhibited heightened emotionality, which may have contributed to the lack of significant symptom improvement	-	13 patients (48,1%) reported an improvement	6 patients (22,22%) reported an improvement
In the medium severity group (8 patients)	1 case (12,15%) showed complete reduction of symptoms	5 cases (62,5%) reported significant improvement with very rare episodes of urine loss	2 cases (25%) experienced slight symptom improvement, with these patients also displaying increased levels of emotionality	-	-	4 patients (50%) reported a progress	1 patient (12,5%) reported an improvement

Tabel 1. The results after 3 months of therapy with solifenacin 10mg per day

	Complete Remission	Significant Improvement	Mild Improvement	Slight Improvement	Minor Benefits	Quality of life	Quality of sexual life
Therapy in the group with mixed urinary incontinence (15 patients)	9 patients (60%) experienced complete remission of symptoms	4 patients (26,6%) reported a notable improvement in urinary symptoms, although they experienced occasional episodes of involuntary urine loss	2 patients (13,3%) showed slight amelioration of their symptoms	-	-	10 patients (66%) reported progress	8 patients (53,33%) reported an improvement
In the group of patients with overactive bladder experiencing mild forms (27 patients)	13 patients (48,14%) reported a total remission of symptoms	7 patients (25,9%) reported a notable improvement in urinary symptoms, although they experienced occasional episodes of involuntary urine loss	8 patients (29,6%) experienced a mild improvement in their symptoms	3 patients (11,11%) experienced a mild improvement in their symptoms	4 patients (14,8%) noted minor benefits regarding their symptoms. Notably, all 4 of these patients exhibited heightened emotionality, which may have contributed to the lack of significant symptom improvement	12 patients (44,44%) reported progress	14 patients (51,85%) reported an improvement
In the medium severity group (8 patients)	2 cases (25%) showed complete reduction of symptoms	4 cases (50%) reported significant improvement with very rare episodes of urine loss	2 cases (25%) experienced slight symptom improvement, with these patients also displaying increased levels of emotionality	-	-	5 patients (62,5%) reported progress	6 patients (75%) reported an improvement

Tabel 2. The results after 6 months of therapy - 3 months of the combined Kegel exercises with solifenacin 10 mg per day.

The ability of patients to control urinary continence and tone pelvic muscles led to an enhanced quality of sexual life.

4. Discussion

In our study, we established specific criteria to define conditions to categorize patients into two groups: SUI (35 patients) and MUI (15 patients).

Defining urinary loss in overactive bladder

The loss of urine in an overactive bladder is referred to as urge incontinence. This means that involuntary urine loss occurs, and it is preceded by or happens simultaneously with a strong, sudden urge to urinate, also known as urgency. This urge can be so strong that it's challenging to control. Sometimes, urge incontinence can involve uncontrolled urine loss between bathroom visits or a sudden and complete emptying of the bladder [1, 2, 3].

It's important to note that urge incontinence is different from stress urinary incontinence, which is urine loss triggered by actions like coughing, sneezing, or physical exertion. However, a person can experience both types of incontinence, which is called mixed urinary incontinence [4, 6, 15].

The table (Table 3) below highlights the key differences between SUI and OAB:

Feature	Stress Urinary Incontinence (SUI)	Overactive Bladder (OAB)
Definition	Urine leakage with increased abdominal pressure	Urinary urgency, with or without leakage, due to involuntary bladder contractions
Primary Symptom	Leakage during exertion	Urgency
Underlying Cause	Weakened pelvic floor muscles, urethral sphincter dysfunction	Involuntary detrusor muscle contractions

Table 3. Differences between SUI and OAB - Overlapping Symptoms: Mixed Urinary Incontinence.

The high incidence of this condition, which is often underreported, makes it a genuine public health concern. All patients who experienced symptom improvement reported an increase in self-esteem, better work performance, and an enhanced quality of sexual life. The outcomes were favorable for both therapies, but results were better for the combined therapy (with comparative percentages on quality of life and sexual quality of life).

Incidence, social, economic, psychological, implications of urinary incontinence.

In the United States, approximately 34 million adults living in the community are affected by overactive bladder. The economic burden of managing urinary incontinence and overactive bladder is significant, costing an estimated \$19.5 billion and \$12.6 billion annually, respectively. As the population ages, these costs are expected to rise [4].

Socially, urinary incontinence can lead to feelings of embarrassment, frustration, and isolation, reducing quality of life and affecting social relationships. In severe cases, the condition can even result in institutionalization, as individuals struggle with daily management challenges [4, 7, 16].

Circumstances

Uninhibited detrusor contractions: The defining characteristic of an overactive bladder, is the presence of detrusor instability or hyperactivity. This means the detrusor muscle, responsible for bladder emptying, contracts involuntarily even when the

bladder is not full. In this context, these uninhibited contractions are the primary circumstance leading to urinary incontinence [7, 12].

Urgency and frequency: The involuntary detrusor contractions in the overactive bladder result in a sudden, compelling urge to urinate (urgency), often accompanied by increased urinary frequency (urinating more often than usual), even during the night (nocturia). This constant urge to urinate creates a circumstance where incontinence is more likely, as the individual may not always be able to suppress the urge or reach the toilet in time [4, 12].

Patients with neurological conditions were excluded from our study according to the exclusion criteria.

Neurological influences: Although the exact mechanisms are not fully understood, some sources suggest that neurological factors play a role in an overactive bladder. This is supported by the observation that conditions like multiple sclerosis and stroke, which affect the nervous system, can lead to detrusor hyperactivity. Additionally, the sources explain that lesions in specific brain regions, particularly the pons, can disrupt normal bladder control, potentially contributing to overactive bladder and incontinence [4, 7, 12].

Although our sample included only young patients, the incidence of this condition increases significantly with age.

Prevalence increases with age: Detrusor overactivity (DO) becomes more common as people get older, with a notable increase after age 65. This suggests age-related changes in the bladder, nerves, or muscles may play a role [4].

The quality of life of the patients improved significantly as their symptoms decreased. These findings indicate a positive response to the pharmacological therapy with solifenacin succinate 10 mg per day, in managing mixed urinary incontinence and indicate a positive response to the therapeutic intervention, highlighting the effectiveness of the combined Kegel exercises and solifenacin in managing urge and mixed urinary incontinence.

The ability of patients to control urinary continence led to an enhanced quality of sexual life.

Impact on quality of life: DO can significantly affect a person's quality of life, leading to social embarrassment, limitations on activities, and potential medical complications. This emphasizes that DO is not just a physical condition but also has psychosocial implications [4, 7, 17].

Etiological factors

Idiopathic causes: In many cases, the exact cause of OAB, and consequently urge incontinence, remains unknown. This is referred to as idiopathic detrusor instability. However, some authors suggest a possible link to alterations in detrusor morphology (structure) and innervation (nerve supply) or even genetic factors [1, 7, 14].

Neurological factors:

Detrusor morphology and innervation: The changes in the structure and nerve supply of the detrusor muscle itself might contribute to an overactive bladder, though research in this area is ongoing. These changes could involve [1, 7]:

- Hypertrophy of muscle fibers
- Collagen infiltration
- Reduced number of nerve endings

Other factors: Certain factors can worsen symptoms and contribute to incontinence [5, 7, 13, 15, 16, 18, 19]:

- Urinary tract infections (UTIs) can irritate the bladder and exacerbate urgency and frequency;
- Psychological factors: Anxiety and stress can worsen bladder symptoms;
- Certain medications: Some medications, like diuretics, can increase urine production and potentially worsen incontinence;
- Pregnancy (transient stress urinary incontinence);

- Obesity;
- Smoking;

It is important to note that OAB is a clinical diagnosis, primarily based on symptoms and voiding diaries. Urodynamic testing, such as cystometry, can confirm the diagnosis by demonstrating uninhibited detrusor contractions.

Patients with urinary infections, those undergoing diuretic treatment, and pregnant women were not included in our study by the exclusion criteria. The sample consisted only of patients with near-normal body weight. Smoking could not be considered an etiological factor in our study. Psychological factors appear to be the most challenging to address. Anxious or highly emotional patients did not show clear symptom improvement with medication alone, nor with the combination of medication and Kegel exercises.

The importance of Kegel exercises

Kegel exercises, also referred to as PFMT, involve a series of voluntary contractions and relaxations of the pelvic floor muscles [8]. These exercises are designed to strengthen the muscles that support the bladder, uterus, rectum, and urethra, thereby enhancing pelvic health. Kegel exercises are widely recognized for their role in the prevention and management of pelvic floor dysfunctions, including urinary incontinence, fecal incontinence, and pelvic organ prolapse.

Kegel exercises are superior to vaginal electrostimulation for managing urinary incontinence, as the latter can lead to adverse reactions such as discomfort, muscle spasms, and potential infections, while Kegel exercises promote pelvic floor strength without these risks.

Definition and uses of kegel exercises

Kegel exercises consist of repeated contractions and relaxations of the pelvic floor muscles. A proper contraction can be visualized as an upward lift and squeeze of the muscles surrounding the pelvic openings. Although these exercises are often recommended for women after childbirth, they can also be beneficial for men representing a non-invasive and effective strategy for improving pelvic health [2, 10]. By enhancing muscle tone and endurance, these exercises contribute significantly to urinary and fecal continence, sexual function, and overall pelvic health [8, 11].

It is important to note that in some instances, SUI may only become apparent after correcting a coexisting prolapse, known as occult SUI [20, 21, 22].

In addition to Kegel exercises, numerous other treatments for urinary incontinence are being investigated, ranging from pharmacological therapies utilizing selective norepinephrine and serotonin reuptake inhibitors to minimally invasive laser procedures; recent studies have also highlighted the detrimental role of smoking in this condition, with observed improvements following cessation of tobacco use [19, 23, 24, 25, 26].

Stem cell therapy shows promise in restoring normal urethral sphincter function, as evidenced by positive results in pre-clinical studies, which have subsequently prompted clinical trials on its effectiveness [18, 27].

Applications of Kegel exercises:

Stress Urinary Incontinence: PFMT strengthens the muscles that support the bladder and urethra, improving bladder control and reducing urine leakage during activities such as coughing, sneezing, or exercising. Studies have shown that consistent practice can lead to significant improvements in SUI symptoms [8, 9, 28, 29, 30, 31].

Urge Urinary Incontinence (UUI) and Overactive Bladder: Kegel exercises can help suppress bladder contractions and extend the time between urges to urinate, providing relief for individuals experiencing UUI or OAB [8, 32].

Pelvic Organ Prolapse (POP): While further research is necessary, preliminary findings suggest that PFMT may help strengthen pelvic floor muscles, potentially preventing or slowing the progression of POP [8].

Fecal incontinence: By strengthening the muscles responsible for bowel control, PFMT may improve symptoms of fecal incontinence, enhancing overall bowel function [8, 10].

A study confirms a close association between anal incontinence and SUI, highlighting that many women with SUI also experience symptoms of anal incontinence, particularly for gas [19].

Sexual function: Strengthening the pelvic floor muscles can enhance sexual sensation and may improve erectile dysfunction in men and sexual satisfaction in women [9, 10].

It is proven that incorporating Kegel exercises into a daily routine not only helps prevent or manage urinary incontinence but can also enhance sexual satisfaction, both postpartum and in other clinical situations.

Some studies have demonstrated that postpartum women who consistently perform Kegel exercises report greater sexual satisfaction and improved sexual function compared to those who do not. This underscores the importance of these exercises not only for managing urinary incontinence but also for enhancing sexual health and well-being in the postpartum period [33, 34].

A study on 30 women diagnosed with urinary incontinence shows a significant impact of Kegel exercises on enhancing sexual satisfaction in women with urinary incontinence. Results indicated a positive effect, with notable improvements in the subscales of female avoidance and anorgasmia. Factors such as age, number of pregnancies, and type of last delivery were found to influence sexual function, revealing that women aged 35 and older, those with four or more pregnancies, and those who had vaginal deliveries experienced more sexual dysfunction. Additionally, urinary incontinence was shown to negatively affect women's sexual lives, leading to concerns about odor, restricted fluid intake, and avoidance of sexual activity [35].

The effectiveness of Kegel exercises for various types of urinary incontinence has been proven to be significant. Over time, studies have been conducted to support and demonstrate the efficacy of these exercises for both women and men.

A study aimed to compare the effectiveness of Kegel exercises and extracorporeal magnetic innervation (EMI) in treating stress urinary incontinence found that EMI is significantly more effective in stimulating and strengthening the pelvic floor muscles, reducing both the symptoms and the frequency of urinary incontinence episodes [36].

A Cochrane review evaluating the effectiveness of PFMT as a treatment for Urinary Incontinence (UI) in women found evidence supporting PFMT over no treatment, placebo, or inactive controls. The review also concluded that further research is needed to assess the outcomes of PFMT, both as a standalone treatment and in combination with other therapies for women with UI [37].

In our study, after six months of therapy, patients in the combined therapy group demonstrated substantial improvements across various metrics compared to those receiving medication alone. Specifically, 60% of patients with mixed urinary incontinence achieved complete remission of symptoms, whereas only 33% of those in the medication-only group reported similar outcomes.

Moreover, 66% of patients in the combined therapy group noted an improvement in their quality of life, compared to 40% in the medication-only group. Similarly, 53.33% of patients reported enhanced sexual quality of life, a significant increase from the 13.3% observed in the medication-only cohort.

These findings underscore the importance of incorporating Kegel exercises into treatment plans for urinary incontinence. Kegel exercises can be successfully performed by patients with cardiovascular issues, because the cardiovascular strain level of these exercises is safe [38].

Kegel exercises can be performed with difficulty by patients with ovarian tumors. It is well known that one of the main symptoms of ovarian tumors is pelvic pain [39]. Kegel exercises can accentuate pelvic pain in these cases.

Another study published in Healthcare in 2022 examined the effects of a Kegel exercise training program on urinary incontinence in women. The study found that Kegel exercise training programs are highly effective in treating urinary incontinence in women, leading to statistically significant improvements in symptoms and overall quality of life [40].

5. Conclusions

The combination of Kegel exercises and solifenacin represents a more effective therapeutic approach than pharmacological treatment alone for patients with urinary incontinence.

Kegel exercises play a crucial role in educating patients about pelvic floor muscle control and alleviating symptoms associated with both overactive bladder and mixed incontinence.

The combination of solifenacin and pelvic floor exercises significantly improves urinary continence, reduces symptoms, and enhances overall quality of life and sexual satisfaction. Thus, the synergy between medication and Kegel exercises offers a promising strategy for the effective management of this condition.

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