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# Long-Term Follow-Up of the In-Flow™ Intraurethral Insert for the Treatment of Women with Voiding Dysfunction

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**Key Words**

Voiding dysfunction · Micturition · Clean intermittent catheterization · Treatment

**Abstract**

***Objective:*** The aim of the current study is to report the long-term follow-up of women treated with the In-Flow™ device for periods longer than 1 year.

***Methods:*** The efficacy of the intraurethral insert was evaluated in 92 women. Data regarding their urodynamic diagnosis, complications and satisfaction were collected.

***Results:*** Early and late discontinuation of the device use was recorded in 52 patients (56.5%) and 19 patients (20.6%), respectively. Twenty-one patients (22.8%) are now being followed for more than 1 year with a follow-up time of 12–44 months (mean 24.6). Complications include device migration into the bladder (4 patients), asymptomatic bacteriuria (15 patients), and symptomatic urinary tract infections (4 cases, 1 of them pyelonephritis). In the 3 women who were sexually active before treatment, the use of the device did not preclude sexual intercourse, although mild dyspareunia was reported in 1 patient. Two patients complained of episodic inconvenience between their legs during walking. All patients were satisfied with the device and preferred it to previous treatment modalities used. The reasons for early and late discontinuation of treatment are described and discussed.

***Conclusions:*** The In-Flow™ intraurethral insert can serve as a long-term treatment for the management of women with voiding difficulties. Women who continue treatment for a prolonged time are satisfied with the device use. Further studies comparing this treatment with other modalities are needed to support the role of the In-Flow™ device in the management of women with voiding dysfunction.



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## Introduction

Voiding difficulties or bladder emptying dysfunction result from a failure of the detrusor muscle to contract appropriately (atonic or hypocontractile bladder), failure of pelvic floor relaxation, or combination of the two. The etiologies of bladder emptying dysfunction are numerous and many disciplines in medicine are involved in the diagnosis and treatment of the disorder. Patients may present with complaints of urinary frequency, urgency and incontinence, while symptoms less frequently encountered include postvoid fullness, poor flow (prolonged or intermittent stream), hesitancy, and complete urinary retention. Inadequate bladder evacuation can result in increased postvoid residual (PVR) urine with possible severe complications such as recurrent urinary tract infections, bladder stones and impaired renal function. Hence, failure to empty the bladder should be treated. The traditional treatment of choice is clean intermittent catheterization as described and popularized by Lapides et al. [1], but many patients find it an arduous psychological burden. Other treatment modalities include pharmacological therapy, indwelling urethral catheter, sphincterotomy or even urinary diversion [2, 3]. These treatments may be effective in prevention of voiding dysfunction complications, however, many patients find them discouraging, imposing lower quality of life and decreased sense of self-esteem. Newer modalities of treatment include electrical stimulation to the bladder wall, pelvic nerve, sacral root and spinal cord [4–8]. Selective detrusor activation, and direct stereotactic selective stimulation of the sacral cord have been more recently suggested, but are still considered experimental [9, 10].

The In-Flow™ intraurethral insert has been previously described as a treatment option in women with voiding dysfunction. Short-term results were encouraging. Although early device removal was recorded in 49% of the patients due to local discomfort or urinary leakage around the insert, that was done after a short trial period (mean of 7.1 days) and without any damaging sequelae. With a follow-up period of up to 26 months (mean 7.6), 51% of the patients continued treatment with the device to their satisfaction. Using multivariate analysis, the only predictor of early discontinuation of the device use was the absence of previous treatment for voiding dysfunction [11].

The aim of the present study is to describe the long-term follow-up of the In-Flow™ intraurethral insert for the treatment of women with voiding dysfunction. The population of this study is different from the previous study as all patients were recruited and followed in Israel.


**Fig. 1.** The In-Flow™ intraurethral insert and the activator.

## Materials and Methods

The In-Flow™ intraurethral insert (Influence, Inc., San Francisco, Calif., USA) has been previously described [1]. In brief, it is a short silicone catheter with an internal valve and pump mechanism (fig. 1). A specially designed disposable inserter is used to introduce the catheter into the urethra. The insert is fixed in position by flexible silicone fins at the level of the bladder neck and by a flange at the external urethral meatus. The catheter is easily removed by pulling its external flange or by manipulating the flange causing collapses of the flexible silicone fins. Periodic replacement of the insert is performed by a caregiver or by the patient herself.

The valve and pump mechanism contains a tiny magnet in its core that is remotely energized by the In-Flow™ activator (fig. 1). To urinate, the activator is held at the pubic area near the urethral opening, and its 'on' button pressed. Thus energized, the valve of the device opens and the miniature rotor spins so that the pump draws urine from the bladder allowing the patient to 'void' with a urine flow of 10–12 $cm^3/s$ (average flow rate). At the end of urination, the pump ceases to rotate and the valve closes to regain continence.

Between May 1995 and July 1998, 92 women with urinary retention and voiding difficulties were enrolled in the study in Israel. Their data were collected at the Bnai-Zion Medical Center, Haifa, Israel. The medical charts of 21 patients using the device for more than 1 year were retrieved. The data of their urodynamic diagnosis, satisfaction and complications were collected. The information regarding 71 patients who stopped using the device was also gathered.

Pretreatment evaluation included history-taking, symptoms questionnaire, physical examination, pad count, urodynamic evaluation, urinary ultrasonography or intravenous pyelography, urine culture and routine blood tests.

Insertion of the catheter is performed as a simple ambulatory procedure very similar to urethral catheterization. The urethral meatus is prepared with antiseptic. In order to select the correct size for the device to fit the individual patient's urethra, a Foley cathether with measurement length readings was introduced into the bladder and the balloon inflated. The cathether was then pulled back gently to locate the balloon at the bladder neck. The measurement length reading on the

catheter was noted, then the balloon was deflated and the catheter removed. The length of the insert used was 0.5–1 cm longer than the measured length of the urethra in order to avoid pressure of the device at the bladder neck and the meatus. The tip of the insert is lubricated, and inserted into the urethra until its outer flange reached the external meatus. At this point, the inserter is squeezed between the fingers and thumb until the insert is released from the inserter. The inserter is then removed and discarded. Patients are given prophylactic antibiotics for 5 days. To urinarte, the patient sat on the toilet of if bedridden, laid or her back with a basin between her legs and the activator operated as described above.

Posttreatment follow-up consisted of a monthly visit for the first 3 months and then visits once in every 3 months. In addition to routine follow-up visits to the urology outpatient clinic, a registered nurse dedicated to the treatment and follow-up of these patients is available for the time of the study for routine replacement of the inserts (when this is not done by the patient herself or her caregiver) and for the periodic collection of data. Her telephone number is available to the patients should any problem arise. Data collected included symptoms questionnaire, urinalysis and culture, blood urea and creatinine levels, and PVR urine volume measurement every 3 months. Patients satisfaction was evaluated by asking the patients if they are unsatisfied, satisfied, or very satisfied with the device use.

## Results

Ninety-two women, 16–88 years old (mean 56), were enrolled in the study. In 59 patients the cause for emptying dysfunction could not be established. Causes of voiding difficulties included multiple sclerosis (n = 10), followed by prior pelvic surgery and external radiation (n = 9), diabetes mellitus (n = 8) and spinal stenosis or injury (n = 6). Pretreatment cystometry revealed concomitant detrusor instability in 20 patients. These patients were treated with anticholinergic drugs prior to device insertion and along the device use period. Previous treatments for voiding dysfunction included indwelling catheter in 19 patients and clean intermittent catheterization in 50 patients. The remaining 23 patients remained untreated. Insertion of the prosthesis was performed as described above with no pain or complication noted.

In 52 patients (56.5%) the device was removed after a mean of 7.3 days (range 1–14) and they were considered inadequate for this mode of therapy. The causes for device removal (table 1) were local discomfort in 33 patients, urinary leakage around the device in 11 patients, and inconvenience operating the device (technical difficulty) in 6 patients. In 2 patients the device was repeatedly expulsed during urinations. Seven of the 11 patients who had urinary leakage around the device had detrusor instability prior to treatment. Six other patients developed de-novo leakage while using the device. Nineteen patients (20.6%) stopped the device use later on during follow-up (3–16 months, mean 6). Reasons for late discontinuation of the device use are (table 2): local discomfort in 2 patients, dyspareunia or reluctance to use the device during sexual intercourse in 5 patients, physical or mental deterioration making the device use impossible in 3 patients, death of unrelated disease (myocardial infarction) in 2 patients, inability or unwillingness to pay for the device in 2, and spontaneous expulsion of the device in 1 patient. Two patients, 1 of them with a history of abdominoperineal resection and external irradiation, discontinued the use of the device after spontaneous improvement was noticed (PVR $<$100 ml without the insert) 3 and 6 months after initiation of treatment.

Using the device, all patients were dry and had complete emptying as demonstrated by periodic ultrasonography or catheterization. The device was replaced every 5–99 days (mean 38) during the first phase of the study. Then, the device was replaced regularly every 4 weeks unless earlier blockage of the lumen due to salt deposits inside the device occurred.

Twenty-one patients (22.8%) are now being followed for more than 1 year. Follow-up time ranged between 12 and 44

**Table 1.** Reasons for early discontinuation of the In-Flow™ intraurethral insert

| Patients (n = 52) | Reason for In-Flow™ discontinuation | Time to quit, days |
|---|---|---|
| 33 | Local discomfort | 1–3 |
| 11 | Urinary leakage | 3–6 |
| 6 | Technical difficulty operating the device | 3–6 |
| 2 | Spontaneous expulsion of the device | 14 |

**Table 2.** Reasons for late discontinuation of the In-Flow™ intraurethral insert

| Patients (n = 19) | Reason for In-Flow™ discontinuation | Time to quit, months |
|---|---|---|
| 4 | Local discomfort | 3 |
| 2 | Spontaneous improvement in PVR | 3,6 |
| 5 | Dyspareunia or hesitance to use the device during sexual intercourse | 2–5 |
| 3 | Physical or mental deterioration | 6–8 |
| 2 | Death of unrelated disease | 14, 16 |
| 2 | Unwilling/unable to pay for the insert | 6, 7 |
| 1 | Spontaneous expulsion of the device | 8 |

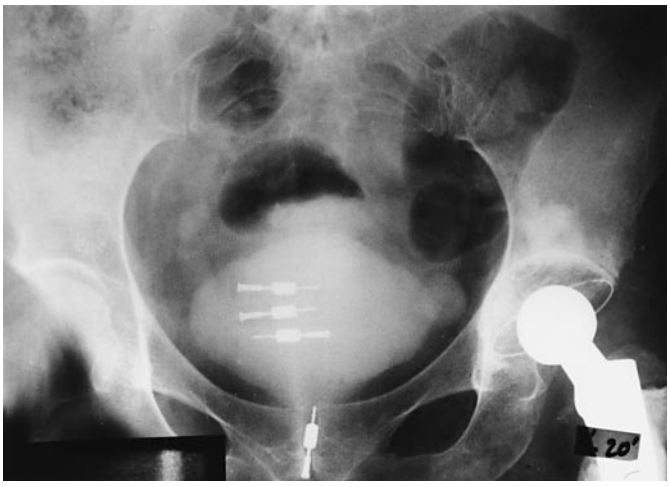

**Fig. 2.** A palin abdominal X-ray film with three In-Flow™ inserts that have migrated into the bladder. Note also another device in its correct location inside the urethra.

months with a mean of 24.6 months. Six inserts used by 4 patients had to be removed cystoscopically after they have migrated into the bladder. In 2 patients the insert migrated during sexual intercourse. One patient was treated by a local nurse, who was not aware of the fact that the used device had first to be withdrawn before a new insert is introduced into the urethra. This patient presented to a follow-up visit with frequency and urgency. A plain abdominal X-ray film revealed three devices inside her bladder (fig. 2). Two devices migrated into the bladder due to a tear in the silicone sleeve of the insert. After the catheter was removed from the bladder, these women resumed using the insert satisfactory and maintained an active sex life.

Among the 21 patients who were followed for more than 1 year, 15 (71.4%) developed asymptomatic bacteriuria. Four episodes of symptomatic urinary tract infection were recorded, of them one upper urinary tract infection (pyelonephritis). Symptomatic urinary tract infections were resolved with oral antibiotics and insert replacement in the case of lower urinary tract infection and with insert removal, temporary indwelling catheterization and parenteral antibiotics in the case of upper urinary tract infection. In the 3 women who were sexually active before treatment, the use of the device did not preclude sexual intercourse, although mild dyspareunia was reported in 1 patient. Two patients complained of episodic inconvenience between their legs during walking. Blood urea and creatinine levels remained unchanged. All patients who continued treatment were satisfied or very satisfied with the device. Patients previously treated by other means preferred to use the device over clean intermittent catheterization or indwelling catheter.

## Discussion

A variety of treatment modalities are now suggested for the treatment of voiding difficulties. The traditional treatment of choice is clean intermittent catheterization promoted and popularized by Lapides et al. [1]. Other treatment modalities aimed at preventing the complications of failure to empty the bladder include pharmacological therapy, indwelling urethral catheter, sphincterotomy, or even urinary diversion [2, 3]. Although these treatments may prevent the complications of voiding dysfunction, it is at the expense of quality of life. Attempts to elicit detrusor contraction by electrodes implanted at the bladder wall, pelvic nerve, sacral nerve root, and spinal cord are another approach to the treatment of voiding dysfunction [4–7]. These attempts produced artificial micturition patterns with high intravesical pressures and involuntary movements of the lower limbs. Shaker and Hassouna [8] have recently reported on sacral nerve neuromodulation (S3 foramen implant) in 20 patients with nonobstructive chronic urinary retention. All patients were reported to have at least 50% improvement in voided and PVR volume, and all patients reported subjective improvement in all symptoms. However, sacral root neuromodulation requires percutaneous nerve evaluation to determine the response to treatment and then a surgical procedure to implant the unilateral sacral foramen electrode and pulse generator. The follow-up presented is limited with only 8 and 5 patients being followed for 1 year and more than 18 months respectively. Furthermore, sacral nerve stimulation is not devoid of complications such as implant failure, battery failure, implant infection, electrode migration, pain at the implant site, and wound infection and dehiscence.

A selective detrusor activation using tripolar electrode with anodal blocking of the large fibers innervating the urethral sphincter, and direct stereotactic selective microstimulation of the sacral spinal cord are other recently introduced modalities for the treatment of voiding dysfunction but are still considered experimental and their clinical application is in question [9, 10].

The ideal treatment should allow the patient to completely evacuate the bladder and to remain continent between urinations with minimal disturbance to routine daily life. In an attempt to achieve these goals a temporary remote-controlled intraurethral insert was designed. The ear-

ly results of the device use in 17 patients were previously published [12]. Lonter-term results of a study conducted in hospitals in Germany and in Israel were recently published: 51% of the 92 patients enrolled in the study continued the device use for a mean follow-up period of 7.6 months (range 2–26). Early withdrawal from treatment was recorded in 49% of the patients enrolled in the study. Patients who stopped the use of the device early (a mean of 7.1 days) did so because of local discomfort or urinary leakage around the catheter [12].

In the present study a similar rate of early discontinuation of treatment was recorded. The reasons for delayed quitting of the device use were unrelated to the medical aspects of the insert in 9 of the 19 patients: 2 died due to myocardial infarction, 3 deteriorated physically or mentally, 2 spontaneously improved with regard to their voiding difficulties, and 2 found the device too expensive. Local discomfort, dyspareunia and spontaneous expulsion of the device were reasons for discontinuation in another 10 patients.

Twenty-one patients continued to use the device for a period longer than 1 year (mean 24.6 months, range 12–44). The use of the device is not complication-free. Adverse effects include device migration, asymptomatic bacteriuria and symptomatic urinary tract infection, among them 1 case of pyelonephritis. After treatment, patients resumed using the device early to their satisfaction. Patients who were previously treated with other modalities for their voiding dysfunction preferred to use the In-Flow™ insert. The cost of using the device in Israel is USD 250 for the remote control (the battery is replaced every 4–5 weeks – USD 6.5) and USD 50 for the intraurethral insert designed to be replaced periodically (every 4 weeks). Currently, patients in Israel are not reimbursed for the use of the device by managed care or by insurance companies. All women participating in this study were made aware of the cost of CIC as an alternative treatment (one rubber catheter that can be reused after boiling or heating in a microwave), and most of them had CIC as a prior modality of treatment. Nevertheless, only 2 out of the 40 patients who continued treatment after the first trial period stopped using the device because of inability or unwillingness to pay for it. We believe that a patient's willingness to pay for the device for prolonged periods of time is further evidence of satisfaction and the economic acceptability of the insert.

We believe that after being informed of the short- and long-term discontinuation rates, and given the fact that patients who discontinue treatment are not seriously harmed in any way, women with voiding dysfunction should be given the chance to try this device for a therapeutic option.

Controlled studies comparing the In-Flow™ device with other treatment modalities such as clean intermittent catheterization are still lacking. The results of our study suggest that a long-term treatment with the In-Flow™ insert is both feasible and satisfactory for women with voiding dysfunction. Further follow-up and controlled studies are necessary to substantiate the role of this device in treatment of women with voiding dysfunction.

## Conclusions

This In-Flow™ remote-controlled intraurethral insert can serve as a long-term treatment alternative in the management of women with voiding difficulties. Women who continue treatment for prolonged periods of time are satisfied with the device. Patients should be followed throughout their treatment for possible complications. Further controlled studies comparing this treatment with clean intermittent catheterization and other treatment modalities are needed to substantiate the role of the In-Flow™ insert in the management of women with voiding dysfunction.

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