

AN INTENSIVE PROGRAMME FOR PELVIC FLOOR MUSCLE EXERCISES: SHORT- AND LONG-TERM EFFECTS ON THOSE WITH STRESS URINARY INCONTINENCE

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Pelvic floor muscle exercises for the treatment of stress urinary incontinence were reported 45 years ago. However, few studies have been made on the long-term outcome and clinical effects in elderly people. We put 123 incontinent women on an intensive exercise programme for 8 weeks and followed them for more than 12 months; 15 patients were over 65 years old and 108 under 65 years old. Self-reported success rates, i.e., cure or a reduction of >50% of the original severity, were prospectively assessed in the 2 groups immediately and a mean of 28 months (12–52) after the training. Predictive parameters for an immediate and a long-term success were assessed. The intensive programme depended on patients being motivated, patient education, correct muscle contractions, and the keeping of treatment diaries for 8 weeks.

Urine loss evaluated objectively and bothersome scores in 6 activities assessed subjectively improved only in the younger adult group. However, vaginal contractile strength increased in both groups. The immediate success rate was 20% and 40% for the elderly and the adults, respectively. Twenty eight months later, the success rate was 27% for the aged and 40% for the adults with 6 patients becoming continent by surgery. Both the short- and long-term success rates were similar in the 2 groups ($p < 0.05$). 95% of the patients stated that the intensive training was valuable and that they would recommend the training to friends suffering from stress incontinence. Contractile strength of the vagina can be used to predict the immediate treatment outcome, but there are no parameters for predicting the long-term success.

In conclusion, the intensive programme of pelvic floor muscle exercises is an effective treatment option for not only for the young adults but also for elderly people suffering from stress incontinence.

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Key words: Stress incontinence, Intensive programme, Pelvic floor muscle exercises, Long-term results, Predictive parameters

INTRODUCTION

In a quarter of a century those aged 65 years or more will constitute approximately 25% of the total population of Japan, and other developed countries will share a similar experience. The elderly complaining of stress incontinence will also increase in number and non-surgical and/or non-pharmaceutical treatment modalities will be preferable and necessary to deal with these patients. Although pelvic floor muscle exercises were tested 45 years ago¹⁾, few clinical studies have been reported on the long-term effects^{2–5)} and the clinical effects in the aged remain unknown. Herein, we, prospectively assessed the short- and long-term treatment results of an intensive exercise programme in the elderly and younger adults, and examined the benefits of muscle training,

with stress incontinence were invited to take courses of intensive pelvic floor muscle exercises conducted by our experienced physiotherapists (R.M. & R.N.). Of them, 123 patients consisting of 15 elderly people ≥ 65 years of age and 108 younger adults < 65 years, completed an 8-week program but the remaining 6 did not. A mean of 28 months (12–52) after the training, a postal questionnaire was sent to all 123 patients and replies were received from 118 (96%). The patients' characteristics are tabulated in Table 1. Six patients (5%) had previously undergone surgery for stress incontinence which failed, and concurrent ailments of minor degrees such as hypertension, diabetes mellitus, uterine myoma and osteoporosis were present in 27 (22%). The only parameter which differed between the 2 groups was age.

In the 1st and 9th week a modified pad-test⁶⁾ and the contractile strength of the vagina were objectively assessed and "bothersome scores" relating to urinary

PATIENTS AND METHODS

During a 5-year period (1990–1994), 129 women

Table 1. Patient characteristics in the 2 groups

Group	Age	Parity	Pad test (g/h)	Obesity \$	Hysterectomy	Surgery #	Ailments@
The elderly (n= 15)	69 (4)	2.6 (1.0)	21.1 (41.8)	107 (10)	6 pts	2 pts	6 pts
The adults (n=108)	51 (7)	2.3 (0.7)	13.0 (14.9)	103 (14)	10 pts	4 pts	21 pts

Numbers in parentheses : standard deviation. \$Obesity=body weight/(body height minus 100). #Previous failed surgery for stress incontinence. @Concurrent ailments with stress incontinence.

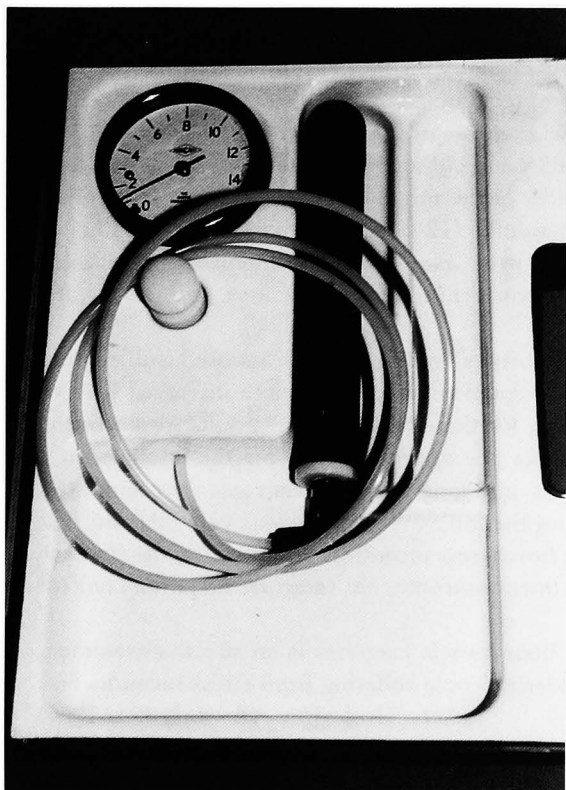


Fig. 1. A perineometer for assessing the vaginal contractile power.

incontinence were subjectively evaluated. Vaginal contractile power was calculated as the mean of 2 measured values which were obtained in a lithotomy position by placing a perineometer (Don Cast, Surrey, UK) in the vagina (Fig. 1). 10 units equals 22 cmH₂O and 16 units is the highest value this device can measure. Bothersome scores were registered on a 100 mm visual analogue scale (100 being the highest bothersome score and 0 the lowest) representing confidence in being able to maintain continence during 6 different social and sports activities: (i) walking, laughing, and sneezing (daily life); (ii) playing sports vigorously (sports); (iii) going to a party or going out in formal dress (party); (iv) getting on a bus, a train, or a subway (transportation); (v) washing hands in cold water (hand-washing); and (vi) having coitus (coitus). Bothersome scores⁷⁾ were evaluated by 74 patients who had joined the program since 1993. Patients' subjective evaluations

were categorized as success or failure. The form is consistent with those having complete cure or a reduction of >50% of the original severity, the latter a reduction of <50% of the original severity or unchanged or aggravated results. In a postal questionnaire subjective assessment of the exercises and 2 questions were asked, namely whether the patient thought intensive exercises are of clinical value, and whether she would recommend this programme to any of her friends suffering from stress incontinence. Finally, 7 parameters obtained prior to the training were compared between those with success and those with failure to predict the immediate and long-term outcome, i.e., age, parity, obesity, history of hysterectomy, amount of urine loss, mean of bothersome scores, and vaginal contractile strength.

Statistical analyses were done with the Mann-Whitney U-test, Wilcoxon signed-ranks test, and chi-squared test (Stat View J-4.5, Abacus Concepts). Methods, definitions and units conform to the standards recommended by the International Continence Society, except where specifically noted⁸⁾

PELVIC FLOOR MUSCLE EXERCISES

(1) Education: At the first session anatomical and physiological principles concerned with continence were briefly explained using a plastic model of the pelvis (ZKK-264-S, Fisions Scientific Equipment, Leics, UK). We emphasized that 2 modes of muscle contraction are necessary during exercises: one is to slowly contract to the maximal strength in 3 sec and to hold for the next 5 sec, and the other is fast and maximal contractions for 1 sec. The necessity for these different contractions is based on the fact that large proportions of the pelvic floor muscles and the urethral sphincter are comprised of the slow twitch fibers (type I), and small proportions of fast twitch fibers (type II).^{9,10)}

(2) Motivation: Patients have to be highly motivated during the 8-week treatment period. Formation of groups with approximately 10 patients (not more than 12) was useful in allowing patients to get to know each other, in preventing dropouts and in encouraging competition among themselves. A physiotherapist should always express her concern about the results of treatment and verbal encourage-

ment during the muscle strengthening exercises is mandatory.

(3) Muscle contractions: The pelvic floor muscles relevant to continence are mainly composed of the levator ani muscle, urethral sphincter and deep perineal muscle (urogenital diaphragm)^{11,12)}. Recognition of correct contraction of these muscles is difficult for some patients. In the first session we place 2 fingers inside the vagina while in a lithotomy position. After the vaginal canal is distended with fingers in a longitudinal direction, patients are then asked to contract the vagina to close the fingers. Furthermore, we tell them that the muscles involved have to be pulled inwards in a cranial direction. Correct contraction of the pelvic floor muscles, resulting in squeezing the fingers, is the most important requirement for successful outcome. If the wrong muscles are used in these contractions, the fingers inside will be pushed out. By gradually increasing the strengthening contractile power, more and more motor units will be recruited and the power will become stronger. These contractions should be assessed at least once or twice during the 8-week programme. Contraction and relaxation of the muscles can be practiced in several postures (Fig. 2). Postures 1 to 4 are recommended in the beginning because patients can use them with comfort and can perceive the muscle contraction with relative ease. In posture 5 the muscles are to be contracted just before the patient touches the floor when jumping which is, because of difficulty in practicing, introduced in the second half of the training. Posture 6 illustrates that a patient inserts her finger(s) in to the vagina and confirms correct contraction of the pelvic floor muscles while taking a bath.

(4) Auxiliary measures: Vaginal cones (Femina; Senshin Medical, Tokyo) were utilized 15 min twice daily to strengthen the muscles through a biofeedback

mechanism in all the patients. Interruption of urinary stream was recommended 2 to 3 times a day to 23 patients who took part in the programme after 1994. These 23 women attempted interruption on a uroflowmeter every week they attended the session and visually confirmed completeness of the interruption. A treatment diary was given to each patient, in which they recorded completion of the recommended amounts of exercises. Patients were requested to bring their diary every time they visited the hospital, and it was checked and stamped by a doctor or physiotherapist.

(5) Clinical assessment: On a daily basis patients practiced 3 sets of 10 slow and 5 fast contractions, twice inserted vaginal cones, and interrupted the urinary stream a few times. They were requested to attend all the clinical sessions, which lasted 90 min once a week for 8 weeks. At each visit patients reported what they practiced and how incontinence altered, attended a question and answer session, did general stretching of all the muscles, and then exercised to strengthen the pelvic floor muscles. On the last visit (9th week) treatment effects were subjectively and objectively assessed and a group picture taken. Three months after the group therapy, the patients were recalled to report any progress or deterioration during the interval, and vaginal contractile strength was assessed. They were encouraged to continue the muscle contractions and the group picture was handed out.

RESULTS

Changes in objective parameters for the elderly and adult groups were assessed (Table 2). Amount of urine loss decreased only in the adult group, but vaginal contractile strength significantly increased in both groups. Subjective bothersome scores in all the 6 activities improved in the adults but not at all in the

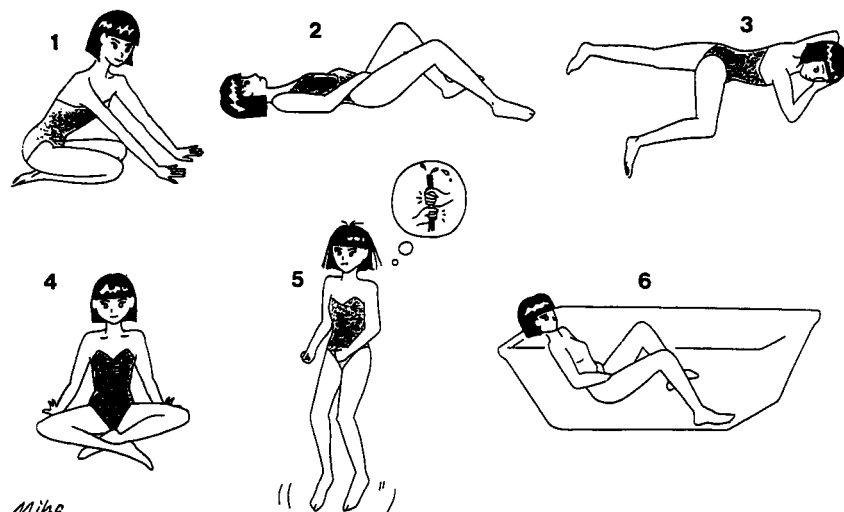


Fig. 2. Postures for the pelvic floor muscle training (1 to 5) and for patient's perception of correct muscle contractions in a bath tub (6).

elderly (Table 3). While immediate success rates were 20 % and 40 % for the elderly and the adults respectively, 28 months later the success rates were 27 % for the aged and 40 % for the adults with 6 patients becoming continent by surgery (Fig. 3). Both the short- and long-term success rates were similar in the 2 groups ($p > 0.05$). Postal questionnaires revealed that 95 % of the patients thought the exercise valuable and would recommend the training to a friend. Of the 7 parameters only vaginal contractile strength was found useful in predicting immediate

treatment outcome but there were no parameters predicting long-term results (Table 4).

DISCUSSION

Although pelvic floor muscle exercises have recently attracted much attention, little is known regarding how to train the patients and what they should be taught. In 1991, we visited a few leading centers in Europe where the muscle exercises were taught, and found that there was no gold standard for the treatment regimen. Subsequently we formulated our own training programme which was refined from time to time to be beneficial to as many patients as possible. It was rather surprising to find that the majority of patients had forgotten or were ignorant about the continence mechanism that requires contractions of the pelvic floor muscles or simply crossing of the lower extremities when coughing or lifting. Reappreciation of this simple fact through patient education was quite useful and essential in decreasing urine loss. At the very least patients should be taught basic anatomy. Bø et al.,¹³⁾ who found that patients treated under an intensive programme experienced favorable treatment outcome

Table 2. Changes in objective parameters

Patients: Before & after exercises	Pad-test (g/h)	Vaginal contractile strength
The elderly		
Before	21.1 (41.8)	6.5 (3.2)
After	21.6 (33.3)	7.7 (3.4)*
The adults		
Before	13.0 (14.9)	4.8 (3.0)
After	5.9 (10.1)**	6.1 (3.2)**

Numbers in parentheses: standard deviation,

* $p < 0.05$, ** $p < 0.01$

Table 3. Changes in bothersome scores

Patients: Before & after exercises	Daily life	Sports	Party	Trans- portation	Hand- washing	Coitus
The elderly						
Before	64	57	44	57	34	26
After	47+	52+	33+	46+	23+	0@
The adults						
Before	55	72	37	33	19	24
After	26 **	40**	18**	15**	14**	14**

** $p < 0.01$, + $p > 0.05$

@Since only one patient responded, analysis was impossible.

Patients	Treatment Results (n=123)	
	Immediate	28 months later
The elderly	Success 3 (20%)	4 (27%)
	Failure 12 (80%)	2 (13%) Operated on 9 (60%)
The adults	Success 43 (40%)	41 (40%)
	Failure 65 (60%)	4 (4%) Operated on 58 (56%) 5* No reply

Fig. 3. The immediate and long-term success rates were similar in the 2 groups ($p > 0.05$). Two adult patients who reported immediate success and 3 adult patients who reported immediate failure gave no reply.

Table 4. Predictive parameters for immediate and long-term outcome

Outcome	Age	Parity	Obesity	Hysterectomy (pts)	Urine loss (g/h)	Bother #	Vaginal contractile strength
Immediate Success (n=46)	52.7 (7.2)	2.3 (0.8)	104 (12)	4	10.2 (11.4)	35.5 (24.2)	5.8 (3.2)
Immediate Failure (n=77)	53.1 (10.2)	2.4 (0.8)	105 (14)	12	16.2 (23.2)	43.5 (19.8)	4.6 (2.8)
Long-term Success (n=45)	54.9 (7.1)	2.4 (0.9)	105 (13)	5	11.6 (12.5)	31.7 (22.1)	5.6 (3.3)
Long-term Failure (n=67)	51.7 (9.7)	2.3 (0.8)	105 (14)	9	13.1 (16.0)	43.7 (19.9)	4.9 (2.8)

Numbers in parentheses: standard deviation

#Bother: a mean of bothersome scores in 6 activities. *p<0.05

far more readily (60 %) than those treated less intensively (17 %), were the first to stress that patient motivation is important. Small patient groups, verbal encouragement, weekly visits to the hospital, and the keeping of treatment diaries to be stamped by us seem to have contributed to attaining this objective. Patients must learn that the pelvic floor muscles have to be contracted in the correct way. The volume of the female urethral sphincter is so small¹⁴⁾ and the sphincter is so powerless that women rely heavily on the contracting power of the pubococcygeal muscle, one of the levator ani muscles, which squeezes the urethral and vaginal canals and pushes them against the pubic bone. We encourage patients to recognize this squeezing feeling on their finger(s) placed in the vagina during a bath. An inward or upward movement of the levator ani muscle is also an important maneuver to practice. Some physiotherapists claim that muscle contractions should be repeated >100 times a day and should be practiced at any place and at any time. We feel that these views are completely wrong and impractical, and that quality should always have priority over quantity. Patients are better recommended to practice maximal contractions of the muscles approximately 40 to 50 times a day in a quiet situation. Vaginal cones have been utilized with all our patients in the hope of strengthening contractile power. However, incontinent patients whom we have treated in the past with vaginal cones clearly demonstrated that the devices were only effective for those who suffered from a slight degree of stress incontinence^{15,16)} Pieber et al.¹⁷⁾ reported that vaginal cones did not change any urodynamic parameters and that the success rate in those treated with vaginal cones and who performed pelvic floor exercises was similar to that in those who performed pelvic floor exercises alone. It is likely that cones may help indicate via biofeedback mechanism to patients the whereabouts of the muscles to be

contracted and motivate them to repeat contractions, and that the direct effect due to cone retention will be limited to those with slight incontinence. Since 1994 we instructed 23 patients about the interruption of the urinary stream, and this exercise has been useful in that patients can auditorily confirm completeness of the muscle contraction. Some people fear that this might lead to poor voiding habits and incomplete bladder emptying, but this was not the case.

In the elderly group urine loss and bothersome scores did not improve at all, and only vaginal contractile power was strengthened. On the other hand, all these 3 parameters improved in the adult group. These differences were reflected in the self-reported success rates, although there were no statistical differences between the 2 groups. Long-term follow-up data is rare. Mouritsen et al.²⁾ conducted the exercises with 76 patients and found an immediate cure of 17 % which increased to 32 % 1 year later. Hahn et al.⁴⁾ observed an immediate cure rate of 23 % in 170 patients treated for 1 to 18 months, which 4.3 years later reduced to 11 %. Cammu and Nylen⁵⁾ treated 48 patients for 10 weeks with an immediate cure rate of 25 %, which changed to 32 % 5 years later. These long-term results together with our own seem to suggest that once a certain level of continence is established through the muscle training the clinical effect can be maintained over time, probably because patients have come to understand the mechanisms of continence and learned how to effectively contract the muscles when needed.

Because of disparate treatment regimens with differing periods of treatment, various ages and severities of incontinence, and, most of all, different criteria of evaluation for the therapies, meta-analysis is almost impossible. Fukui et al.¹⁸⁾ reported that of the 22 patients who were treated with pelvic floor muscle exercises 8 (36 %) were judged very successful and 13 (46 %) improved immediately after exercises. Bø mentioned that patients' subjective evaluations of

condition and the amount of urine loss were necessary for evaluating the effects of the physiotherapy¹⁹⁾. We support her idea and recommend that evaluation criteria for the muscle exercises be expressed as self-evaluated success or response rates: success comprising those with complete cure or those with a reduction of >50 % of original severity. Amounts of urine loss, vaginal contractile strength, duration of the physiotherapy, and subjective bothersome scores should be reported.

We found that vaginal contracting strength was of use as an immediate predictive parameter, i.e., those with a stronger contractile power have a greater chance to be successful. However, prediction of long-term outcome was not possible, partly because one quarter of the patients actually shifted from success to failure or vice versa during the 28 months (Fig. 3), and partly because motivation of each patient which was not quantitatively assessed here seemed to play a more important role in deciding long-term outcome than the 7 parameters. Normal contracting power of the vagina in continent women seems interesting and should be clarified. This value assessed in several continent, sexually active women ranged from 12 to more than 16, which was almost 3 times as strong as those of incontinent women. Our predictive parameter was partly in accordance with those reported by Bø and Larsen²⁰⁾ who compared various parameters between the responders (n=8) and borderline responders (n=15). These authors found that age and a social activity index besides the contracting power could be used to predict the outcome, findings which we could not confirm. Their parameters of age and a social activity index may not be valid since their analysis was based on only 23 patients. Although treatment results of this non-surgical method is obviously inferior to those of surgery, it can be recommended as a first-line treatment option especially for the elderly and the frail. Since we found that the factor of age did not negate the treatment outcome, it should be safe to say that any elderly patient who wishes to be treated with this physiotherapy can be enrolled and be expected to gain the same benefits as younger adults, and that selecting in advance those having stronger vaginal contractile power will increase the success rate.

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和文抄録

骨盤底筋体操の強化訓練法
—腹圧性尿失禁に対する短期、長期治療成績—

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骨盤底筋体操は、45年前に腹圧性尿失禁に対する有用な非外科的治療法であると報告された。しかしながら、その長期成績および高齢者に対する治療成績はほとんど報告されていない。われわれは1990年～1994年にかけて腹圧性尿失禁に罹患する女性患者123名を、骨盤底筋体操の強化訓練法で8週間治療し、12カ月以上にわたり経過を観察した。15名は65歳以上（高齢者群）であり、108名は64歳以下（成人群）であった。体操終了時と平均28カ月後の治療成績を前向きに検討し、さらに治療成績の予測因子を調査した。尿失禁の完全消失または50%以上の改善症例を成功群とした。強化訓練の主要な内容は、尿禁制機構に関する患者教育をおこない、患者の治療意欲を高揚させ、鍛練する筋肉群を的確に認識させ、8週間にわたり治療日誌を付けさせることである。

腔収縮力は両群で改善したが、失禁量と尿失禁に基因する困窮度は、成人群のみで有意に改善した。高齢者群と成人群での短期成績はそれぞれ20%と40%であった。平均28カ月後の長期成績は27%と40%であり、6名はこの間に手術をうけて尿禁制となっていた。短期および長期治療成績は、それぞれ両群間で統計的に有意差を認めなかった ($p>0.05$)。95%の患者は強化訓練法が有用であり、友人にこの訓練法を推奨すると述べた。骨盤底筋体操が成功するための短期予測因子は強い腔収縮力であったが、長期治療成績を予想する因子は存在しなかった。骨盤底筋体操の強化訓練法は、腹圧性尿失禁に罹患する成人群ばかりでなく高齢者群にも有用と結論する。

(泌尿紀要 **42**: 853-859, 1996)