Research Report

#5352

peripartum pelvic pain exercises

Diagonal Trunk Muscle Exercises in Peripartum Pelvic Pain: A Randomized Clinical Trial

Background and Purpose. Exercises for low back and pelvic pain are supposed to increase muscle force to reduce symptoms, but they could exacerbate symptoms by loading of the spinal and pelvic structures. The purpose of this study was to investigate the value of graded exercises of the diagonal trunk muscle systems. **Subjects.** The subjects were 44 women with persistent pelvic pain after pregnancy (mean age=31.7 years, SD=3.2, range=23.6–37.5; mean period postpartum=4.1 months, SD=2.2, range=1.7–5.6). **Methods.** Subjects were randomly assigned to 1 of 3 groups: (1) a group that performed exercises to increase the force of the diagonal trunk muscle systems, (2) a group that received training of the longitudinal trunk muscle systems, and (3) a group that was instructed to refrain from exercises. Pain, fatigue, perceived general health, and mobility of the pelvic joints as measured with radiographs were the outcome measures. **Results.** After 8 weeks, no differences were found among the 3 groups. **Conclusion and Discussion.** In treating patients with persistent pelvic pain, training of the diagonal trunk muscle systems, without individual coaching, has no additional value above instructions and use of a pelvic belt without exercises. Whether the treatment is ineffective or whether exacerbation of symptoms due to loading of the spinal and pelvic structures obscures any potential benefit of increased muscle force cannot be determined from the study design. [Mens JMA, Snijders CJ, Stam HJ. Diagonal trunk muscle exercises in peripartum pelvic pain: a randomized clinical trial. *Phys Ther.* 2000;80:1164–1173.]

Key Words: *Low back pain, Physical therapy, Pregnancy, Pubic symphysis, Randomized clinical trial, Sacroiliac joint.*

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Pain in the lumbar spine and pelvic region frequently complicates pregnancy and delivery; the cumulative 9-month incidence during pregnancy has been reported to range from 48% to 56%.[1–4] In retrospective studies among young and middle-aged women with chronic low back pain, 10% to 28% stated that their first episode of back pain occurred during pregnancy.[5,6]

Many hypotheses on the pathogenesis of peripartum pelvic pain focus on decreased stability of the pelvic girdle.[7–13] These hypotheses are based on the assumption that stability of the pelvic girdle is provided, in part, by the coarse texture of the sacroiliac (SI) cartilage surfaces, the complementary ridges and grooves, and the undulated shape ("form closure")[7–9] and, in part, by compressive forces of muscles, ligaments, and the thoracolumbar fascia ("force closure").[7–13] Muscles that generate a force perpendicular to the SI joints or that increase tension on the sacroiliac ligaments or thoracolumbar fascia could generate forces that stabilize the SI joint.[8–13] The internal and external oblique abdominal muscles (which we refer to as the "anterior diagonal trunk muscle system") and the latissimus dorsi muscle, the transversospinal parts of the erector spinae muscle (especially the multifidus muscle), and the gluteus maximus muscle (which we refer to as the "posterior diagonal trunk muscle system") seem to be appropriate for this task.[8–13]

From this perspective, we believe that training of the diagonal trunk muscle systems will benefit people with peripartum pelvic pain, partly by increasing muscle force and endurance (the ability to function over a long period of time).[8–13] We believe that many patients reduce peripartum pelvic pain with therapy that focuses on increased force production. It remains unclear, however, whether success is real and, if so, whether it is due to the increased stability resulting from the increased force of the diagonal trunk muscles, or to spontaneous recovery, placebo effects, or applied co-interventions. Exercises to achieve this goal of increased force production could exacerbate symptoms by the loading of the spinal and pelvic structures.[14] The purpose of our study was to investigate whether the results of treatment of peripartum pelvic pain with graded exercises of the diagonal trunk muscle systems are better than the results without these exercises.

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The study was approved by the Ethics Committee of the University Hospital Rotterdam.

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Methods

Study Population

Participants were selected from 1,248 patients who, during a period of 2½ years, contacted the outpatient clinic of the Institute of Rehabilitation Medicine of the University Hospital Rotterdam in the Netherlands. A brochure with information about peripartum pelvic pain and a medical history questionnaire were mailed to all patients, and 891 questionnaires were returned. Eighty-four patients appeared to fulfill the selection criteria and were invited to visit the outpatient clinic and to participate in the trial. A physical examination was performed, routine blood tests (ie, sedimentation rate, white cell count, hemoglobin, alkaline phosphatase, calcium) and urine tests (ie, protein, glucose, sediment) were made, and radiographs of the lumbar spine and pelvis were made according to the procedure described by Chamberlain.[15] In the second selection phase, 40 patients were excluded for various reasons (Figure), 11 of them because they were treated with exercises during the waiting period between the registration and the first examination.

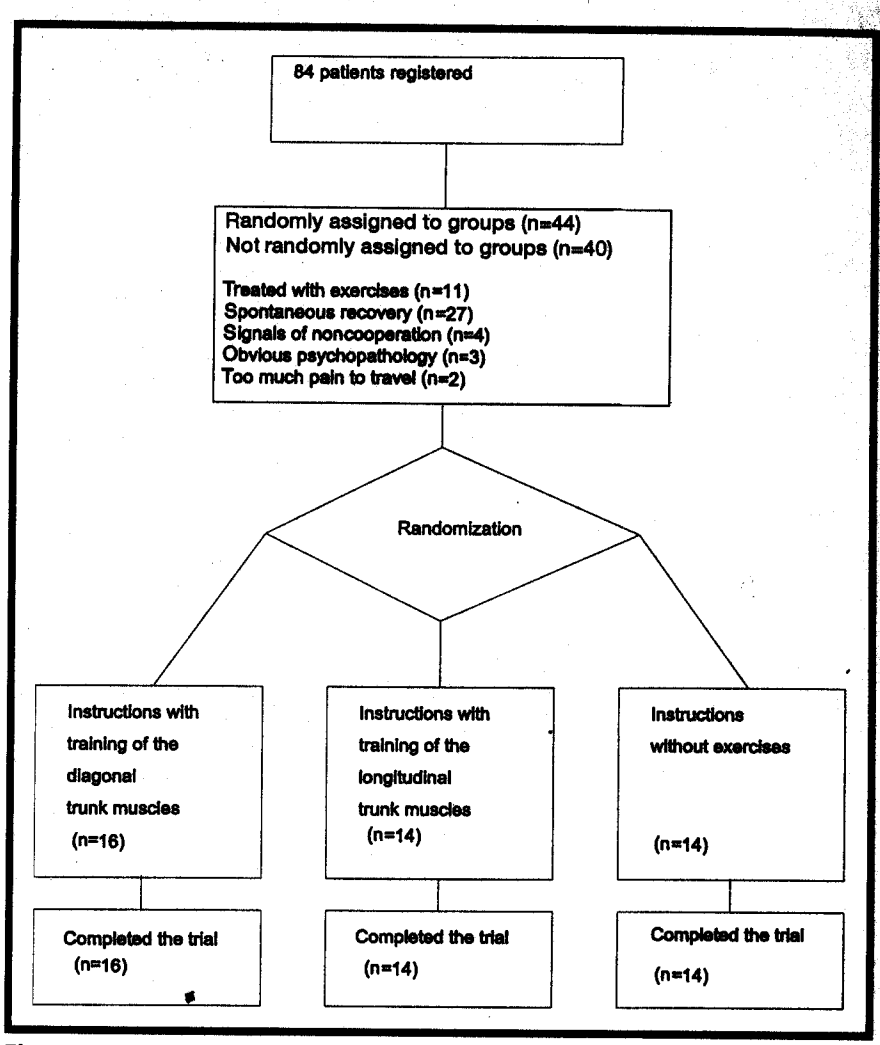

Figure.
Overview of the patient selection and distribution process. In the "treated with exercises" category, many patients contacted a physical therapist to be treated with exercises as soon as they heard from our administrative assistant that we did a trial about the use of exercises. In the "spontaneous recovery" category, the complaints of many patients decreased to such an extent that it would be unethical to attempt exercises. Noncooperation was judged by the examiner and based on the way forms were filled in (not completely) or returned (not returned or returned late) during the weeks preceding random assignment to groups. For example, one patient did not score the visual analog scales for pain and tiredness on the first 2 forms. After a telephone call from the administrative assistant to discuss this, the patient subsequently did not return any forms. Psychopathology was based on the patients' medical history concerning medical consultations or time lost from work because of psychological problems and on the global impression of the examiner. For example, one patient had been very depressed since childbirth and used antidepressive medication. Too much pain to travel was judged only by the patient.

Inclusion criteria were:

1. The presence of *pelvic pain*, which was defined as pain experienced between the plane through the 4 superior iliac spines and the horizontal plane through the inferior border of the pubic symphysis.

2. Pain that was influenced (increased or decreased) by position and locomotion.

3. Pain that was localized posteriorly as well as anteriorly to the pelvis. This criterion was included in an effort to exclude isolated symphysial osteoarthropathy, as described by Driessen[16] and isolated lumbar problems, as described by Östgaard et al.[17]

4. Pain that started during pregnancy or within 3 weeks after delivery.

5. Not pregnant, and the patient's last delivery was 6 weeks to 6 months previous to the beginning of the study.

6. No history of fracture, neoplasm, inflammatory disease, or previous surgery of the lumbar spine or pelvis.

7. Never treated with exercises for peripartum pelvic pain.

Exclusion criteria were:

1. Patient complaints that were not persistent (defined as improvement in symptoms that took place in the 4 weeks preceding the beginning of the study). The judgment was based on the global impression of the patient and on the impression of the examiner (JM) on the basis of the patient's medical history and the forms completed by the patient during the preceding weeks. The same person examined all patients.

2. Noncooperation or obvious psychopathology, insufficient knowledge of the Dutch language to complete the forms, or visual or auditory handicaps that prevented receiving instructions by videotape. Noncooperation was judged by the examiner and based on the way forms were filled in (not completely filled in) and returned (not returned or returned late) during the weeks preceding the first examination. Presence of psychopathology was based on the patient's medical history concerning medical consultations or time lost from work because of psychological problems and on the global impression of the examiner.

3. Signs indicating the presence of identifiable neurological pathology (asymmetric Achilles tendon reflex, hypesthesia in a radicular pattern, passive straight leg raising restricted by pain in the lower extremity below the knee).

4. Abnormalities on routine blood and urine tests.

During a 2½-year period, 44 women with persistent pelvic pain after pregnancy (mean age=31.7 years, SD=3.2, range=23.6–37.5; mean period postpartum=4.1 months, SD=2.2, range=1.7–5.6) were included in the study. Subjects were randomly assigned to 1 of 3 groups: (1) a group that performed exercises to increase the force of the diagonal trunk muscle systems (experimental group), (2) a group that received training of the longitudinal trunk muscle systems (rectus abdominis muscle, longitudinal parts of the erector spinae muscle, and quadratus lumborum muscle) (control group 1), and (3) a group that was instructed to refrain from exercises (control group 2). No differences between the 3 groups were found for prognostic indicators, co-interventions during the study, and baseline values of outcome measures (Tab. 1).

Interventions

In order to be able to answer our question in a credible fashion, we attempted to make certain that the interventions among the 3 groups were as equal as possible except for the variable being studied. Instruction from the physical therapists of our team required subjects to travel several times to the university hospital. Travel could be fatiguing, especially for subjects who lived far away, and could reduce patient adherence. Moreover, the large variation in travel time (15 minutes to 3 hours) might have reduced the comparability among the subjects. We believed that instruction from a physical therapist in the subjects' own neighborhood was not appropriate because variation in both travel distance and therapist approaches might introduce bias. We decided, therefore, to instruct the subjects by videotape. In that way, we attempted to reduce the variation among groups.

Each subject received a 30-minute videotape in which explanations were given about the possible cause of peripartum pelvic pain, prognosis, and therapeutic possibilities. Furthermore, apart from ergonomic advice, information was given on how to behave if activities caused pain and how to use a pelvic belt (a nonelastic strap that gives support to the pelvic girdle). The last part of the videotape differed, depending on group assignment (Appendix). Videotape 1, which was given to subjects in the experimental group, gave instructions on how to train the diagonal trunk muscle systems. In videotape 2, which was given to subjects in control group 1, there was a demonstration of light exercises of the longitudinal trunk muscle systems, which we viewed as placebo exercises. Videotape 3, which was given to subjects in control group 2, illustrated how subjects should try to gradually increase the activities of daily living and to refrain from exercises. The same individuals described the exercises on each of the videotapes.

The exercises that we chose are based on the opinions of Kendall et al[18] and, therefore, have not been subjected to research. The frequencies were based on the opinions prevalent in sports training[19] rather than on the results of systematic research. In conformity with these opinions, heavy exercises to gain muscle force and endurance were performed 3 times a week. These exercises were partly isometric and partly nonisometric. Two series of exercises were performed, with a rest of 5 minutes between the series of exercises. The subjects had to try to gradually increase the amount of repetitions per series, and they were guided by their pain and fatigue. Light exercises designed to improve muscular awareness and recruitment were performed 3 times a day. To control and facilitate adherence, the subjects had to complete weekly visual analog scales (VASs) for pain and fatigue and send them to an administrative assistant by means of an addressed, prepaid envelope.

A designated form inquired about the subjects' frequency of training, their use of medication or a pelvic belt, whether their general health was disturbed (eg, by a cold or urinary tract infection), and whether they were working. Subjects were given the opportunity to ask

Table 1.
Prognostic Indicators, Co-interventions During the Study, and Initial Values of Outcome Measures[a]

	Experimental Group (n=16)			Control Group 1 (n=14)			Control Group 2 (n=14)		
	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range
Prognostic indicators									
Age (y)	30.7	3.7	23.6–37.2	32.3	3.3	26.2–37.3	32.1	2.2	29.2–37.5
Parity	2.0	0.9	1–4	1.9	1.1	1–4	1.8	0.7	1–3
Duration of complaints (mo)	8.5	1.9	4.7–11.3	9.3	2.3	6.3–13.4	9.1	2.4	3.6–13.3
Period postpartum (mo)	3.9	1.7	1.7–5.6	4.0	1.8	2.3–5.5	4.3	1.3	1.9–5.4
Participants working (%)	6.3			15.4			15.4		
Co-interventions during study									
Use of a pelvic belt (hours per day)	12.4	7.1	0–24	12.5	6.9	0–23.1	11.9	5.8	0–22.7
Use of pain medication (doses per day)	0.59	0.88	0–2.3	0.57	1.12	0–4.0	0.64	1.27	0–4.7
Initial values of outcome measures									
Pain in the morning[b]	36.6	23.7	6–90	35.4	17.5	7–67	37.5	24.8	11–92
Pain in the evening[b]	57.6	10.8	34–73	71.8	23.0	22–95	60.3	19.6	7–89
Tiredness in the morning[b]	46.5	24.4	11–87	33.9	19.9	3–63	37.9	24.2	2–90
Tiredness in the evening[b]	77.0	11.9	32–90	84.4	10.1	49–99	77.2	13.8	47–98
NHP[c] energy	51.4	39.5	0–100	53.9	30.5	24–100	54.2	38.6	0–100
NHP pain	62.4	22.7	6–80	58.9	26.3	19–100	47.3	21.5	0–80
NHP emotional reactions	15.5	17.8	0–51	21.0	19.0	0–63	15.4	15.4	0–52
NHP sleep	15.7	24.6	0–78	14.3	22.6	0–78	6.3	10.2	0–34
NHP social isolation	19.1	19.2	0–65	14.2	16.2	0–45	15.6	24.3	0–84
NHP physical mobility	40.9	21.6	11–68	30.9	16.3	31–16·	36.4	15.5	0–54
PPPP[d] test left (% positive)	91.1			50.0			64.3		
PPPP test right (% positive)	93.7			64.3			71.4		
Radiograph[e]	3.0	2.0	1–8	2.5	1.1	1–4	3.5	2.0	1–7

[a] No differences between groups (one-sided analysis of variance). Intervention consisted of instructions given by videotape and use of a pelvic belt, in combination with training of the diagonal trunk muscle systems (experimental group), training of the longitudinal trunk muscle systems (control group 1), and instructions without exercises (control group 2).
[b] Score on a visual analog scale (0–100).
[c] NHP=Nottingham Health Profile.[20,24]
[d] PPPP test=posterior pelvic pain provocation test.[17]
[e] Movement of the pubic symphysis (in millimeters).

questions. These questions were submitted to the principal investigator (JM) without the subjects being identified by the administrative assistant. The administrative assistant contacted the subjects by telephone if no forms were received or the forms were not completed appropriately, and to answer any questions. To check correctness of the exercise technique, the subjects were asked during the evaluation to demonstrate the way they trained after 8 weeks of intervention.

Assignment

After informed consent was obtained from the subjects, they were given a videotape in a sealed envelope. At home, they played the videotape in order to first learn to which group they had been assigned. Prior to the start of the trial, numbered, sealed envelopes containing a copy of 1 of the 3 different videotapes were prepared in random order.

Outcome Assessment

The outcome of treatment was assessed after conclusion of the 8-week intervention. To prevent the influence of fluctuations of complaints associated with the menstrual cycle, the day of the week, and the hour of the day, the second examination in the hospital was planned to occur exactly 8 weeks after the first examination on the same day of the week and at the same time. Because no agreed-on measures to evaluate treatment for peripartum pelvic pain exist, we decided to use scales for general health: a measure of pain, a measure of fatigue, and the Nottingham Health Profile (NHP).[20] Moreover, we used a posterior pelvic pain provocation test (PPPP test)[17] and a radiographic examination according to the procedure described by Chamberlain.[15] Chamberlain described how mobility of the pelvic joints could be assessed by measuring the shift between the pubic bones when a person stepped with weight bearing while alternating between the left and right lower extremities. Berezin[21] used the Chamberlain method to compare the mobility of the pelvic joints of women with and without pelvic girdle pain in the puerperium. The measured shift between the pubic bones was 5.9±3.3 mm in women with complaints and 1.9±2.2 mm in women without complaints (P=.0000). Because the validity of measurements obtained with the PPPP test and the radiographic

examination as measures of effect is not known, we considered these measurements to be secondary.

Primary outcome measures. The subjects scored their global impression of improvement on a 3-point Likert scale (1=worse, 2=unchanged, 3=improved). The mean severity of pain and fatigue were scored on a 100-mm horizontal VAS by asking subjects to rate their pain (or fatigue) in the morning (or in the evening), where 0 represented "no pain (or not tired) at all" and 100 represented "very severe pain (or extremely tired)."[22,23] Because of the large variation in pain and fatigue between morning and evening, scores were obtained at both times of the day. The subjects were encouraged to complete the forms each week on the same day and at the same hour (preferably during the evening on the weekend). Reliability and validity for these measures have been examined and shown to be good.[22,23]

The 6 main outcome scales of the NHP were used to measure various aspects of perceived health: energy, pain, emotional reactions, sleep, social isolation, and physical mobility.[20] The reliability and validity for this measure for assessing health-related quality of life have been examined and shown to be good.[24]

Secondary outcome measures. Gluteal pain provoked by the PPPP test on the left and right sides was scored on a 2-point scale (yes or no). Radiographic examination was performed to assess mobility of the pubic symphysis during weight bearing while alternating between the right and left lower extremities.

Sample size calculations were based on a clinical success rate in the experimental group of at least 20% higher than in the control groups (outcome measure: global impression of improvement). The target sample was estimated at approximately 30 patients per group (α=.05, β=.20). When about half of the subjects had been enrolled, an interim analysis was planned to investigate whether it was necessary to include 30 subjects per group before conclusions could be made. When 44 subjects were enrolled, this analysis took place and the study was terminated.

Blinding

It was impossible to keep subjects unaware of the kind of intervention they received. Before the subjects were randomly assigned to groups, they were told by the principal investigator that the approach to treatment for persistent peripartum pelvic pain involved the combination of use of a pelvic belt and ergonomic advice and that the study was initiated to answer the question of whether the addition of exercises is beneficial or harmful, or has no influence. In order not to influence the subjects, all the assessment forms had to be completed at home.

The examiner who determined the score of the PPPP test after 8 weeks of intervention was unaware of the subjects' group assignment. Before the examination, the subjects were asked not to inform the examiner about their treatment. The investigator was unaware of the subjects' group assignments during interpretation of the radiographic findings.

Data Analysis

SPSS statistical software* was used for data analysis. The 3 groups were checked when the study began for similarity of prognostic indicators and for initial values of outcome measures. All outcome measurements were analyzed as intention to treat (data obtained for dropouts were included in the results). Changes were calculated for each subject by subtracting the results obtained at the beginning of the study from those obtained after 8 weeks. Differences between measurements obtained at the beginning of the study and at conclusion of the study were analyzed using a one-sided analysis of variance. Categorical data were compared with the Kruskal-Wallis test ($P<.05$ was considered significant).

Subjects in the 2 exercise groups were encouraged to increase the number of repetitions. If a subject was unable to perform the exercises, she could decrease the amount or stop. Four subjects in the experimental group (25%) stopped the exercises due to increase of pain (2 in the sixth week, 1 in the seventh week, and 1 in the eighth week). One subject in control group 1 stopped the exercises due to increased pain in the eighth week. No subject was lost at conclusion of the study. Four subjects (2 in the experimental group and 2 in control group 1) refused to participate in the second examination because of exacerbated symptoms after the first examination; for these subjects, the results were based only on the primary outcome measurements. The 2 subjects in the experimental group who refused to participate in the second examination classified their result as "worse" and stopped the exercises before the end of the study.

All subjects considered the videotape comprehensive, and almost all of the subjects found the information sufficient (they had no further questions about the disease and how to cope with the problems). All subjects in the 2 exercise groups demonstrated that the way they had trained was the correct way. No subjects in control group 2 had performed any structured training.

* SPSS Inc, 444 N Michigan Ave, Chicago, IL 60611.

Table 2.
Effects of 8 Weeks of Treatment for Peripartum Pelvic Pain: Mean Change From Initial Values[a]

Measure	Experiment Group (n=16) $\bar{X}$	SD	Range	Control Group 1 (n=14) $\bar{X}$	SD	Range	Control Group 2 (n=14) $\bar{X}$	SD	Range
Global Improvement									
Better	10 (62.5%)			10 (71.4%)			8 (57.1%)		
Unchanged	3 (18.8%)			4 (28.6%)			5 (35.7%)		
Worse	3 (18.8%)			0 (0.0%)			1 (7.1%)		
Pain in the morning	3.6	23.6	−32–45	8.9	15.7	−16–44	11.4	17.8	−27–47
Pain in the evening	2.0	23.1	−42–47	8.6	14.2	−16–38	6.9	18.4	−25–37
Tiredness in the morning	6.4	33.9	−59–52	7.2	17.9	−26–42	1.4	27.1	−51–61
Tiredness in the evening	16.8	31.5	−56–59	8.9	15.3	−21–36	5.7	24.3	−23–52
NHP[b] energy	8.0	36.3	−61–76	4.3	32.1	−39–76	6.4	40.1	−39–94
NHP pain	12.8	31.8	−74–69	13.7	22.3	−34–49	4.9	26.2	−44–44
NHP emotional reactions	−0.9	14.5	−23–34	3.4	12.1	−21–16	−0.7	13.5	−24–29
NHP sleep	3.0	16.1	−22–40	3.8	22.7	−27–65	3.6	12.0	−13–34
NHP social isolation	2.9	23.9	−35–65	−0.04	12.4	−23–23	6.0	24.1	−23–84
NHP physical mobility	6.2	25.6	−57–35	5.2	12.7	−22–23	6.5	17.5	−31–33
PPPP[c] test left	(n=14)			(n=12)			(n=12)		
Better	5 (35.7%)			4 (33.3%)			2 (14.3%)		
Unchanged	9 (64.3%)			6 (50.0%)			10 (71.4%)		
Worse	0 (0.0%)			2 (16.7%)			2 (14.3%)		
PPPP test right[d]	(n=14)			(n=12)			(n=12)		
Better	7 (50.0%)			3 (25.0%)			0 (0.0%)		
Unchanged	5 (35.7%)			7 (58.3%)			10 (71.4%)		
Worse	2 (14.3%)			2 (16.7%)			4 (28.6%)		
Movement of the pubic symphysis on radiographs (decrease in millimeters)	(n=8) 0.0	1.3	−1–3	(n=10) −0.2	0.79	−1–1	(n=11) 0.7	0.79	0–2

[a] Positive values indicate improvement.
[b] NHP=Nottingham Health Profile.[20,24]
[c] PPPP test=posterior pelvic pain provocation test.[17]
[d] Differences significant ($P<.05$) (one-sided analysis of variance; 2 degrees of freedom).

Results

After 8 weeks of intervention, 28 of the 44 subjects (63.6%) said that they improved, 12 (27.3%) were unchanged, and 4 (9.1%) felt worse ($P=.000$). Of the 5 subjects who stopped the exercises, 1 said that she improved, 1 was unchanged (the subject in control group 1), and 3 felt worse. A decrease in pain scores from 36.3 to 28.6 was found in the morning ($P=.01$), and a decrease in fatigue scores from 77.0 to 66.7 was found in the evening ($P=.01$). Improved scores were also found for the NHP pain scale (from 56.5 to 45.9, $P=.01$) and physical mobility scale (from 36.2 to 30.3, $P<.05$).

Comparison of results at the end of the 8-week intervention showed no differences for the primary outcomes measures between the experimental group and both control groups (Tab. 2). The statement that global improvement in the experimental group was not 20% better than in the control groups could be made with a confidence level of 95% for control group 1 and with a confidence level of more than 99% for control group 2. With respect to change in the PPPP test scores on the right side, the experimental group scored better than the control groups ($P<.05$).

Discussion

We studied patients with persistent pelvic pain after childbirth who were treated for 8 weeks. The results might have been influenced by the way in which instructions were given to the subjects. Patient instruction by videotape has been used for many years for many conditions. For example, since 1985, the American College of Obstetricians and Gynecologists has used videotapes to instruct women who are pregnant or postpartum on how to perform exercises.[25] Instruction given by a physical therapist, in our opinion, would enable more individualized training. Östgaard et al[26] demonstrated

the surplus value of individual-based instructions above group classes. Although we believe that improvement would have been greater with individual instructions, answering the question of our study would have been more difficult with individualized training.

Our results show that 63.6% of the subjects improved during the program. We found no evidence that training of the diagonal muscle systems of the trunk was beneficial for patients with peripartum pelvic pain. There were minimal differences in results between the experimental group and both control groups. After 8 weeks of intervention, a difference was shown in only one item: the PPPP test on the right side improved more in the experimental group than in the control groups. The interpretation of this finding was hindered by the difference in baseline values of the groups for this test. The difference might be the result of a "regression to the mean."

A surprisingly large percentage of the experimental group (25%) had to cease training because of pain or fatigue. Many subjects in this group complained of increasing pain during the exercises; the majority attributed the pain to the exercise aimed at strengthening the hip extensors (ie, raising the lower extremity in prone position).

We conclude that training of the diagonal trunk muscle systems, without individualized coaching, as done in this study, is not more effective than low graded training of the longitudinal trunk muscle systems or no exercises. Training of the hip extensors in our subjects may have increased pain to such an extent that any benefit derived from increased stability of the pelvis was obscured. Vleeming and colleagues[7,10–13] reported that tension of the gluteus maximus and hamstring muscles increases the tension of the ligaments and decreases the mobility of the SI joints. A decrease in the movements of the SI joints may be beneficial, but extra loading on the ligaments probably is not beneficial.

A literature search was made in MEDLINE for the period 1966 to 1998, in the Cochrane Controlled Trials Register,[27] and in the proceedings of the 3 interdisciplinary congresses on low back pain.[28–30] Two randomized clinical trials and 3 nonrandomized intervention studies on peripartum pelvic pain were found.[26,31–34] In the first randomized trial, Östgaard et al[26] investigated the preventive value of a back school education and training program during pregnancy. They concluded that the program could reduce short-term sick leave due to peripartum pelvic pain, provided that the instructions were individual based. Nilsson-Wikmar et al[31] compared the effects of exercises given by a physical therapist with the effects of a program of home training and stretching and with the effects of a program without exercises; no differences were found. Noren et al[34] studied the effects of an individual-based education and training program in patients who were pregnant and had peripartum pelvic pain. They found that days lost to sick leave were reduced in the intervention group compared with a group of women from another antenatal clinic who received no treatment. In a prospective nonrandomized trial, Dumas et al[32] investigated the value of exercise classes in the prevention and treatment of peripartum pelvic pain. They found no effect on back pain during pregnancy and after childbirth. Mantle et al[33] studied the effects of ergonomic advice on the development and course of back pain during pregnancy. The treated group in their study scored better than the control group. The results of our study and the literature search agree with the hypothesis that giving information about peripartum pelvic pain in combination with ergonomic advice is beneficial. Until now, however, the studied exercises have shown no additional value in the treatment of peripartum pelvic pain during pregnancy or during the first 6 months after childbirth.

At the beginning of the study, we hoped that the results would support the hypothesis that training of the diagonal muscle systems in patients with peripartum pelvic pain is better than other exercises or better than no exercises. If this would have been the case, the study would provide a rationale for physical therapy in this patient category. The results suggest that providing appropriate information to a patient with peripartum pelvic pain is useful. The results also suggest that training of the hip extensor muscles in a patient with peripartum pelvic pain may worsen the situation. Neither suggestion, however, was proven in our study. The most important consequence of our study is that the hypothesis about form closure and force closure, described by Vleeming and colleagues,[7,10–13] needs to be revised. It is recommended that studies be done to examine the effect of training the diagonal trunk muscle systems without the hip extensors, eventually in combination with exercises, to strengthen the transverse abdominal muscle. Training of the transverse abdominal muscle has been recommended for lumbar segmental instability[35,36] and as a stabilizer for the pelvic girdle.[9,37]

Conclusion

The results of instruction without exercises were the same as with exercises in reducing symptoms in women who have peripartum pelvic pain after childbirth. Without exercises, the change on somatic fixation is reduced and there is no risk of increase of pain if exercises are too heavy or performed incorrectly. We conclude that treating patients with persistent pelvic pain 6 weeks to 6 months after childbirth by training of the diagonal trunk muscle systems, without individualized coaching, has no

value beyond that achieved with instructions and the use of a pelvic belt without exercises. Whether there will be a greater reduction in symptoms with individualized coaching is not known. Reassurance of the patient and awaiting spontaneous resolution, in combination with instructions and use of a pelvic belt, are, with the present knowledge, our first choice for managing this condition.

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Appendix.
Videotape Instructions

Exercise videotape 1 (experimental group)

Videotape 1 gave instructions for heavy exercises, to be performed 3 times a week (Monday, Wednesday, and Friday), and instructions for light exercises, to be performed 3 times a day. The instructions for heavy exercises were:

Lie back with your knees at 90 degrees of flexion and your feet flat on the support surface. Perform diagonal sit-ups by raising your left shoulder as far as possible in the direction of your right knee. Keep your right shoulder in contact with the support surface. Hold this position for 7 seconds, then lie down, relax for 3 seconds, and repeat the exercise. When this series is completed, perform a similar series by raising your right shoulder. Perform 5 repetitions per series during the first setting.

In a prone position, with your arms lying beside your head, raise your left arm and shoulder from the support surface and raise your extended right leg. Hold this position for 7 seconds, then lie down, relax for 3 seconds, and repeat the exercise. When this series is completed, perform a similar series with your right arm and left leg. After a rest of 5 minutes, repeat the complete program. If performing these exercises provoked no pain or fatigue, increase the number of repetitions to 6 during the next setting, and so on. If you are unable to increase the repetitions because of pain, fatigue, or weakness, you may stay at that level, but you are encouraged to increase the number of repetitions later, if possible. If you are unable to perform the exercises, you may decrease the amount or stop.

The instructions for light exercises on videotape 1 were the same as those for the heavy exercises, except that the tensed position (the position in which the muscles were contracted) was held for only 3 seconds and no second series was done after a rest period. The number of repetitions was the same as for the heavy exercises. Three times a week, when the heavy exercises were done, the light exercises were omitted.

Exercise videotape 2 (control group 1)

Videotape 2 demonstrated exercises to tense the longitudinal trunk muscle systems. The instructions were:

In a supine position, with your knees at 90 degrees of flexion and your feet flat on the support surface, perform a sit-up by raising both shoulders as far as possible in the direction of your knees. Hold this position for 3 seconds, then lie down, relax for 3 seconds, and repeat the exercise. If this series is completed, lift your pelvis from the support surface without tilting your pelvis. Hold this position for 3 seconds, then lie down, relax for 3 seconds, and repeat the exercise. Perform 5 repetitions during the first setting, 6 repetitions during the next setting, and so on. If you are unable to increase the repetitions because of pain or weakness, stay at that level during the remainder of the 8 weeks.

Exercise videotape 3 (control group 2)

Videotape 3 instructed subjects to try to gradually increase their activities of daily living and not to do exercises.