

A Randomized Controlled Trial Comparing 2 Instructional Approaches to Home Exercise Instruction Following Arthroscopic Full-Thickness Rotator Cuff Repair Surgery

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Study Design: A prospective unblinded randomized clinical trial.

Objectives: To compare the effectiveness of 2 types of home program instruction, videotape versus personal instruction by a physical therapist, on subjective outcomes and exercise compliance following arthroscopic repair of a full-thickness rotator cuff tear.

Background: Advances in orthopedic surgery and rehabilitation have placed increased emphasis on home exercise programs. Therefore, assessing the effectiveness of different methods of home program instruction is important.

Methods and Measures: Patients who consented to undergo surgical repair were randomly assigned to either a videotape or personal instruction group. A self-reported compliance log categorized subjects as fully compliant, partially compliant, or noncompliant. The Shoulder Pain and Disability Index and the University of Pennsylvania Shoulder Scale scores were obtained from subjects preoperatively and at 12, 24, and 52 weeks postoperatively. The null hypotheses that neither group would have better outcomes as measured by 2 shoulder outcome scales at any level of compliance over 4 levels of time, were assessed by 2 separate 2×3×4 multiple analyses of variances (MANOVAs), 1 for each outcome measure ($\alpha = 0.025$).

Results: Neither MANOVA was significant and the null hypotheses were not rejected. The main effect of time (number of weeks postsurgery) was significant across all time intervals for both outcome measures ($P < 0.0005$).

Conclusions: With a therapist available for questions, patients who utilized the videotape method for their home program instruction had self-reported outcomes equal to patients instructed in their home program personally by a physical therapist. Self-reported compliance with the rehabilitation program had little effect on the outcomes. *J Orthop Sports Phys Ther* 2002;32:548–559.

Key words: physical therapy, shoulder rehabilitation, shoulder surgery, videotape

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It is estimated that between 0.7% and 2% of the general population per year, and a much larger percentage of athletes, seek medical attention for shoulder complaints.^{3,4,13,22,23,26} One of the more serious shoulder complaints is a full-thickness rotator cuff tear (FTRCT). If patients remain symptomatic after nonoperative care, the surgeon may perform surgical repair of the torn tendon, using either the open, mini-open, or fully arthroscopic technique.² The expenses associated with surgical repair and the necessary postoperative rehabilitation can be quite high. Minimizing the costs through modifications in rehabilitation techniques could be an effective method for lowering the overall health care costs associated with this procedure.^{7,21}

Whether a patient should attend therapy on a frequent basis or complete all exercises at home has been debated. Ellman and Gartsman⁷ recommend supervised rehabilitation 2 to 3 times weekly for 4 months and Gazielly⁸ advocates approximately 40 preoperative and 60 postoperative treat-

ment sessions with a therapist. In contrast, the protocol of Rowe and Leffert¹¹ consists solely of home program instruction. In addition to surgeon preference, pressure from third-party payers to achieve maximal benefits with minimal costs influences both the amount and the methods of rehabilitative care.

Instruction in home exercises after surgical repair of a rotator cuff tear (RCT) is a rehabilitation intervention that can be achieved using more than 1 method. Most often the instruction in the home exercise program occurs one-on-one with a physical therapist in a clinic setting. Videotape-based instruction is an alternative strategy. The benefits of a personal instruction format are that immediate feedback can be given to the patient, modifications can be made to the program, and the patient can be educated in the connection between the exercise program and the achievement of functional goals. However, the cost of providing personal instruction can be high, both in terms of monetary load on the patient and insurance company and patient time. When instruction in the home exercise program is videotape based, the patient can simply take the video home and play and replay it as often as needed. What is lost in this method of instruction is the ability of the therapist to evaluate the patient's technique with the exercises and make appropriate modifications.

The primary purpose of this research project was to compare exercise compliance and subjective functional outcomes for 2 methods of home exercise instruction following arthroscopic full-thickness rotator cuff repair surgery. These 2 approaches were (1) videotape instruction with a video of the exercises to be performed at home given to the patient by a physical therapist, and (2) one-on-one instruction sessions with the same physical therapist. The functional outcome measures included the Shoulder Pain and Disability Index (SPADI) and the self-report section of the University of Pennsylvania (UPenn) Shoulder Scale, measured preoperatively and at 12, 24, and 52 weeks postoperatively. The null hypotheses were that there would be no differences between the 2 treatment groups with regard to either outcome measure used (SPADI or UPenn Shoulder Scale) at any level of compliance over the 4 time intervals.

METHODS

Subjects

Subjects diagnosed with a FTRCT by means of magnetic resonance imaging (MRI) who were willing to undergo arthroscopic repair of the FTRCT were recruited from the patients of an orthopedic surgeon who specialized in treatment of shoulder disorders. Excluded from the study were patients with a diagno-

sis of rheumatoid arthritis and patients who had undergone previous surgery on the involved shoulder. The procedure was fully explained to those interested in participating, and informed written consent approved by the Institutional Review Board at Texas Woman's University was obtained from those willing to participate. Subjects were assigned successive identification numbers. Each number was preassigned either to group 1 or group 2 by means of a coin toss. Group 1 subjects received exercise instruction solely through a videotape given to them during their first postsurgical visit by the physical therapist during their hospital stay. They subsequently saw the therapist on 3 additional postsurgical visits solely for evaluation to progress their program to the next rehabilitative phase, which was also included on the videotape. Subjects in group 2 received 4 separate one-on-one instruction sessions with a physical therapist during the course of the study. Participants in both groups were seen personally by the same physical therapist at 4 postsurgical time intervals (2 weeks, 6 weeks, 12 weeks, and 24 weeks) for evaluation to progress their program. At each visit, those in group 1 received the evaluation and were then instructed to view a videotape at home for complete instructions in their next phase of rehabilitation. Those in group 2 received the evaluation followed by personal instruction in the next phase of their program. Taking approximately 15 minutes for each phase, all exercises were demonstrated, followed by the patient performing each exercise for the requested repetitions, receiving verbal and tactile feedback for correct technique. Both groups were also seen at 52 weeks, but only for data collection purposes. At the beginning of the study, both groups were given the therapist's telephone number and instructed to call if they had any questions throughout the course of the study. The therapist returned calls within 24 hours. Based on an a priori power analysis and assuming an effect size of 0.5 for rehabilitation of the shoulder after surgery, an α of 0.05 (2-tailed), and a power of 0.80, 58 subjects per group were required for this study.⁵ An additional 10% were added to account for possible attrition during the course of the study, increasing the group size to 64 participants per group.

Instrumentation

The SPADI is a self-report, visual analogue scale (VAS) of shoulder pain and disability. The pain subscale has 5 items, and the disability subscale has 8 (Appendix A). The original study completed by Roach et al¹⁶ evaluated the reliability and validity of the SPADI in a group of 37 males ranging from 23 to 76 years of age. A subgroup of 23 participants completed the reliability segment. Roach et al¹⁶ calculated intraclass correlation coefficient (ICC) reliability values over a 24-hour period that ranged from

0.64 to 0.66. Criterion validity was evaluated by correlating SPADI scores with active shoulder range-of-motion measures. These correlation values (r values) ranged from -0.52 to -0.80 . Construct validity was assessed through a principal components factor analysis with and without varimax rotation. All subscale items were found to load on 1 factor without the rotation, but with rotation, 2 factors were produced and some delineation was noted with pain and disability items loading on either of the 2 factors.¹⁶ Additionally, Williams et al²⁴ found the SPADI to be responsive to clinically relevant changes in a group of 102 participants, with a minimum of a 10-point change in the SPADI score in patients with shoulder disorders being indicative of a change in status. These findings were supported by work completed by Roddey et al¹⁷ in a group of 192 persons with various shoulder pathologies. The latter researchers evaluated single-use reliability values for 2 commonly used shoulder scales in relation to the SPADI, including the standard error of measurement (SEM), an estimate of how reliably a scale estimates an individual's true score. They found the SEM value for the SPADI to be the smallest of all 3 scales assessed (calculated at 4.75 points, with a 95% confidence interval range of 9.3 points).

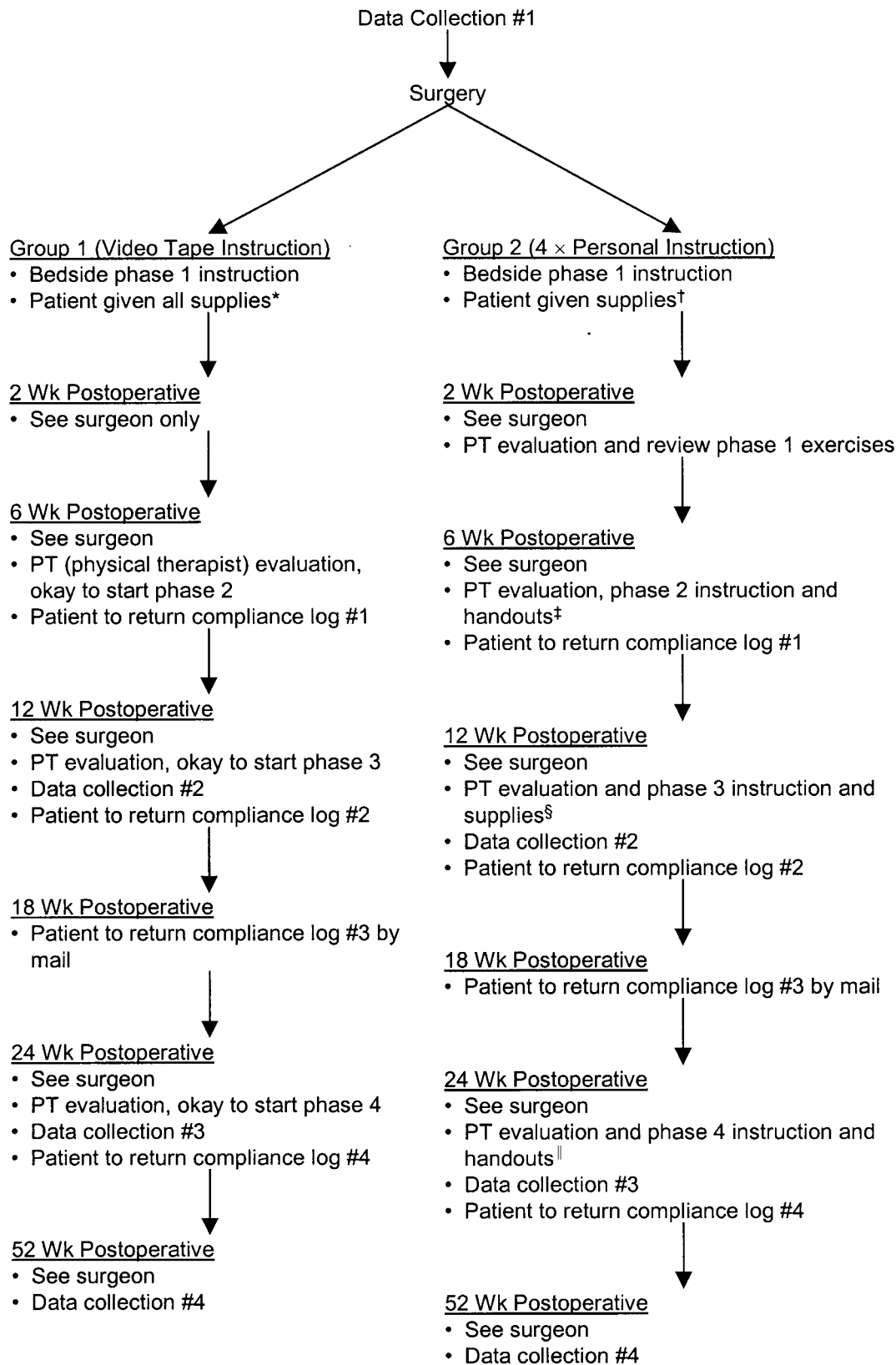
The UPenn Shoulder Scale is comprised both of self-report subscales (pain, satisfaction, and function) and objective assessments (range of motion and strength) (Appendix B).¹² The psychometric properties of the scale were evaluated by Leggin et al¹² on a population of patients with various shoulder pathologies. For the 40 persons included in the reliability portion of their study, they calculated ICC values ranging from 0.88 (pain subscale) to 0.94 (total score) for the test-retest component over a 72-hour period. Validity was evaluated by correlating the UPenn Shoulder Scale score with that of existing shoulder scales. They reported correlation values of 0.85 with the Constant-Murley Shoulder Scale and 0.88 with the American Shoulder and Elbow Surgeons scale. Leggin and colleagues¹² found high internal consistency for the items of the UPenn Shoulder Scale (Cronbach $\alpha = 0.93$) in a sample of 178 patients with various shoulder pathologies. The pain, satisfaction, function, and total scores have score ranges of 0 to 30, 0 to 10, 0 to 60, and 0 to 100, respectively. The standard errors of measurement are small compared to these ranges. The 90% confidence intervals for the pain, satisfaction, function, and total score values were 3.8 to 5.4, 1.3 to 1.8, 6.1 to 8.6, and 8.6 to 12.1, respectively. The correlations of the UPenn Shoulder Scale subscale scores with global ratings of function at baseline ranged from 0.44 (satisfaction) to 0.95 (function). At the 4-week follow-up, correlations with global ratings ranged from 0.62 (satisfaction) to 0.97 (function).

Subject compliance was measured using a 10-cm-long VAS for each week of the first 6 months of rehabilitation. The anchors for the scale were "completed none of my exercises this week" and "completed all my exercises this week." Subjects were instructed to make a mark on the line representative of their completion of the week's exercises.

Procedures

The procedures for group assignment were explained to the participants, who then completed the self-report sections of the 2 shoulder scales. Patients were then scheduled with the orthopedic surgeon for surgical repair of their rotator cuff utilizing a fully arthroscopic approach. After surgery and while still in the hospital, all participants were instructed to wear a provided sling for 6 weeks, removing it only to complete their exercises. All participants received 1 standard physical therapy treatment at bedside, that involved instruction in home wand exercises for supine passive shoulder elevation and external rotation. Additionally, the participants in group 1 were given all rehabilitation materials, as explained in Figure 1. The compliance logs, which included 4 separate log forms with appropriate posted envelopes for return at 6-week intervals, were given to both groups at their bedside visit. At the end of 6 months, all subjects were categorized into 1 of 3 groups according to their overall compliance score. Three studies have shown that average compliance with a home exercise program ranges from 58% to 71% of the requested frequency and number of repetitions.^{9,18,20} Using these studies as a basis for developing categories, criteria were set a priori for each of the 3 compliance levels. A "fully compliant" subject returned all 4 logs and reported completing exercises 70% of the time or more. A "partially compliant" subject returned 3 to 4 logs and reported completing exercises 50% to 69% of the time. A "noncompliant" subject either returned less than 3 logs or reported completing the exercises less than 50% of the time. If the compliance log for a subject had not arrived by the end of the week it was due, a telephone reminder was made to the participant. It was decided for the purposes of this study to define compliance according to the categories stated above, acknowledging the possibility that other factors, such as non-compliance with the documentation and mailing of forms, could affect the classification as well.

Rehabilitation following operative repair of a FTRCT varies, but one commonly used rehabilitation protocol following FTRCT repair consists of 3 distinct phases: passive exercises, active exercises, and strengthening exercises.⁷ Passive exercises are typically performed for the first 4 to 6 weeks after surgery and include passive shoulder external rotation



* All supplies were handouts for each exercise phase, videotape, compliance logs, wand, elastic tubing (3 colors), tubing door attachment loop.
 † Handouts for phase 1 exercises, compliance logs, and wand.
 ‡ Handouts for phase 2 exercises.
 § Handouts for phase 3 exercises, elastic tubing (3 colors), door attachment loop.
 || Handouts for phase 4 exercises.

FIGURE 1. Flowsheet for study procedure, by group.

and humeral elevation along with standard pendulum exercises.^{7,19} Active exercises are then begun and performed for the next 6 weeks and include the same exercises completed actively against gravity.^{7,19} Strengthening exercises are then initiated at 3 months postoperatively and include elastic tubing resistive exercises for all muscles of the shoulder complex.⁷ All participants followed the above program and additionally were instructed, either in person or by videotape, in a final phase. This phase was begun 6 months postoperatively and consisted of free-weight exercises for shoulder complex muscles and weight-bearing exercises for the upper quarter, such as chair press-ups and wall push-ups.¹⁹

Both group 1 and group 2 participants utilized the 4-phase home-based rehabilitation protocol stated above. Both groups initiated the same exercises and completed data collection forms at the same time in their rehabilitation. Both groups were also able to contact the physical therapist by telephone and have any questions or concerns answered. Figure 1 provides further details of the protocol by group assignment.

Data Analysis

The SPADI scores were totaled by adding the distances of each VAS mark for the pain and disability subscales, dividing that total by the possible distances for each subscale, and averaging the pain and disability subscales for 1 total score.¹⁶ The self-report section of the UPenn Shoulder Scale was scored by adding the possible scores for the subscales of self-reported pain (30 points possible), self-reported satisfaction (10 points possible), and self-reported function (60 points possible), for a possible total self-report score of 100 points.¹²

The 2 null hypotheses were that there would be no difference between the 2 treatment groups with regard to either outcome measure used (SPADI or UPenn Shoulder Scale) at any level of compliance over the 4 time intervals. These hypotheses were assessed through 2 separate 3-factor, split-plot, multiple analyses of variance (MANOVA), with type of home program instruction (group 1 or group 2), compliance classification (fully, partially, or noncompliant), and time (presurgical, 12, 24, and 52 weeks postsurgical) as the 3 factors (2×3×4 design) with α set at 0.025. This analysis was completed for each of the 2 dependent variables, the SPADI and the UPenn Shoulder Scale, with the appropriate Bonferroni adjustment made to the α level to account for 2 analyses.

RESULTS

Subjects

Our a priori power analysis required 64 participants per group, for a total of 128 participants. A

total of 129 subjects were recruited and signed informed consent forms. Of the 129 subjects, 21 were eliminated before starting their rehabilitation. Of these 21 subjects, 15 did not schedule operative correction of their FTRCT, 5 had arthroscopic findings inconsistent with a full-thickness rotator cuff tear, and 1 was determined to have a diagnosis of a connective tissue disorder affecting her shoulder. A total of 108 subjects remained to participate in the rehabilitative portion of the study, with 54 subjects in each group (Figure 2). All 108 participants underwent fully arthroscopic rotator cuff repair surgery, with coracoacromial ligament resection, inferior acromioplasty, and medial acromial osteophyte removal as necessary. The number of anchors used ranged from 1 to 3 and the number of sutures from 2 to 6. Five participants additionally had a superior labrum anterior-posterior (SLAP) tear (all repaired), 5 others had a biceps tear (1 repaired, 4 not repaired), 3 persons underwent gentle manipulation at the time of surgery to gain range of motion, and 1 had a Bankart repair. Table 1 lists the demographic information and operative findings of the patients in the 2 groups. Based on independent *t* tests, there were no significant differences ($\alpha = 0.05$) between the 2 groups with regard to age, sex distribution, number of tendons involved, size of tear, or type of insurance. Calculated *P* values are also listed in Table 1.

Attrition

There were participants who failed to appear for 1 or more data collection sessions. This was due to accidents involving the shoulder that required removal

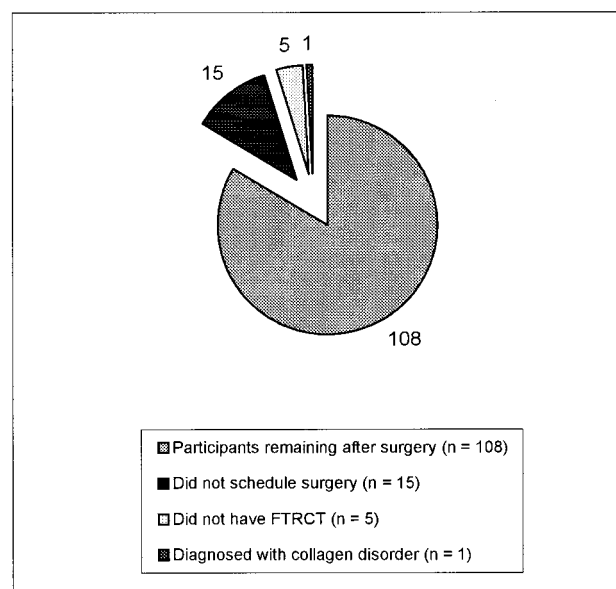


FIGURE 2. Participant removal prior to beginning of rehabilitation, based on surgical findings and/or lack of scheduling for surgery (initial, $n = 129$; FTRCT, full-thickness rotator cuff tear).

TABLE 1. Comparison of demographic information for randomized participants (video, video instruction; PT, physical therapist instruction).

	Group 1 Video (n = 54)	Group 2 PT (n = 54)	P Values*†
Patient age (y)			P = 0.41
Mean (SD)	58.7 (10.6)	57.2 (9.1)	
Range	34.6–78.0	40.0–75.8	
Patient sex			P = 0.55
Males (%)	36 (65%)	33 (61%)	
Females (%)	18 (35%)	21 (39%)	
Number rotator cuff tendons torn‡			P = 0.10
1	38	31	
2	9	15	
3	2	7	
4	1	0	
Size of rotator cuff tear (cm)			P = 0.77
Average size (range)§	2.5 (1.0–5.0)	2.6 (1.5–4.0)	
Number massive tears (>5.0 cm)	4	8	
Patient insurance type filed			P = 0.24
Private insurance	31	34	
Work-related insurance	12	15	
Medicare insurance	11	5	
Compliance level			P = 0.07
Fully compliant	25	36	
Partially compliant	14	10	
Noncompliant	13	8	
Presurgical scores¶			
SPADI mean (SD)	60.4 (22.1)	52.3 (21.6)	P = 0.06
UPenn mean (SD)	37.9 (15.7)	40.9 (16.3)	P = 0.34
12-wk scores#			
SPADI mean (SD)	32.0 (19.7)	26.7 (18.8)	P = 0.17
UPenn mean (SD)	62.6 (17.7)	66.2 (17.5)	P = 0.32
24-wk scores**			
SPADI mean (SD)	18.1 (16.1)	15.3 (15.2)	P = 0.40
UPenn mean (SD)	79.4 (15.5)	79.6 (17.3)	P = 0.95
52-wk scores††			
SPADI mean (SD)	12.3 (14.3)	12.4 (14.4)	P = 0.99
UPenn mean (SD)	85.6 (13.8)	85.9 (16.7)	P = 0.94

* Independent *t* tests performed.† $\alpha = 0.05$.

‡ Data missing for 4 in group 1 and 1 in group 2.

§ Excluding massive tear data.

|| Group 1 video, n = 52.

¶ Group 1 video, n = 51.

Group 1 video, n = 48; group 2 PT, n = 53.

** Group 1 video, n = 42; group 2 PT, n = 48.

†† Group 1 video, n = 31; group 2 PT, n = 37.

from the study, subject preference, or failure to appear for 1 of the scheduled postsurgical appointments. Out of a total of 108 participants remaining after surgery, 40 did not complete at least 1 data collection session. See Figure 3 for the retention of participants over time by group. Data were collected on all but 3 subjects preoperatively (all 3 in group 1), 4 additional subjects were lost at the 12-week session (3 from group 1, 1 from group 2), 10 at 24 weeks (6 from group 1, 4 from group 2), and 20 at the final 52-week session (8 from group 1, 12 from group 2). Out of 71 persons remaining, 3 participants (all in group 1) failed to return 1 data set, yet returned others later in the sequence. These 3 were not in-

cluded in the analysis. Therefore, a total of 68 persons completed all data collection sessions.

Number of Contacts

During the first year of monitoring subjects, any calls or additional personal contacts beyond the scheduled visits were documented. (See Figure 4 for the frequency of contacts by group, over time.) For group 1, a total of 48 additional contacts were made, and for group 2, a total of 46 additional contacts were made. Because the data collected were not normally distributed, a nonparametric equivalent of an independent *t* test (Mann-Whitney *U*) was per-

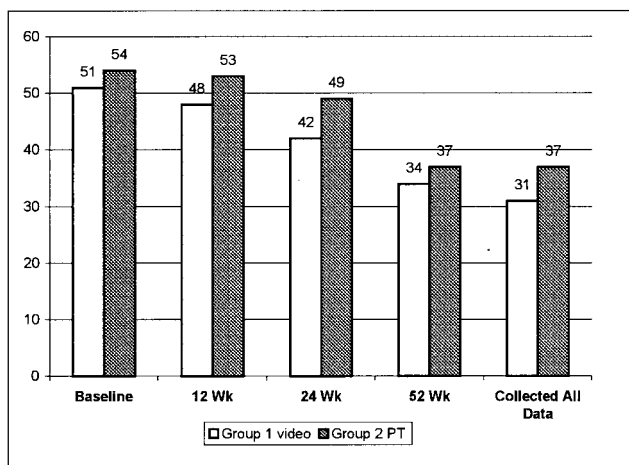


FIGURE 3. Retention of participants over time, by group assignment (video, video instruction; PT, physical therapist instruction).

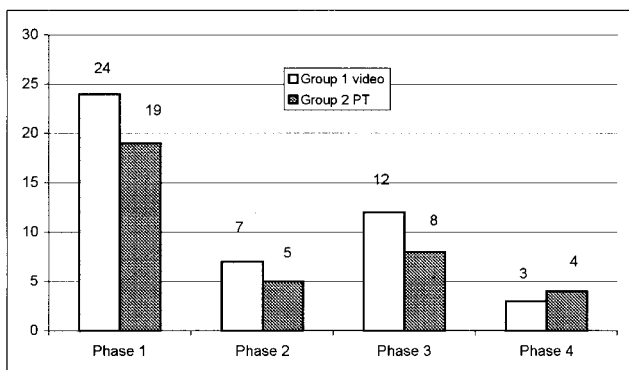


FIGURE 4. Number of additional contacts made by participants, either in person or by telephone, for the purpose of having questions answered regarding their rehabilitation, by group assignment (video, video instruction; PT, physical therapist instruction).

formed. There was no significant difference in the number of contacts between these 2 groups ($P = 0.79$).

Compliance Level

Each participant's compliance categorization was determined by averaging the compliance reported on the 4 compliance logs. Two subjects in group 1 were not categorized because they never returned for any follow-up visits, and no logs were collected from either of them. For the remaining 52 participants in group 1, 25 subjects were categorized as fully compliant, 14 as partially compliant, and 13 as noncompliant. For the 54 participants in group 2, 36 were categorized as fully compliant, 10 as partially compliant, and 8 as noncompliant (Figure 5). Of the 106 categorized participants, 73 returned all 4 compliance logs, with 61 categorized as fully compliant and 12 as partially compliant. The other 33 participants returned 3 or fewer logs. Because an analysis of variance (ANOVA) test is generally robust to moderate violations in homogeneity of variance as long as there are equal sample sizes in each group,¹⁵ a

parametric ANOVA was completed. No difference in compliance was found between groups 1 and 2 ($P = 0.18$).

Null Hypotheses

The null hypotheses were not rejected based on the results of 2 separate $2 \times 3 \times 4$ split-plot MANOVAs. For the dependent variable, the calculated P value for the SPADI was 0.685 and for the UPenn Shoulder Scale 0.325. There were no 3-way or 2-way interactions for either dependent variable. There were no main effects of group or compliance. The main effect of time was significant for both dependent variables ($P < 0.0005$). See Tables 2 and 3 for within-subject and between-subject effects.

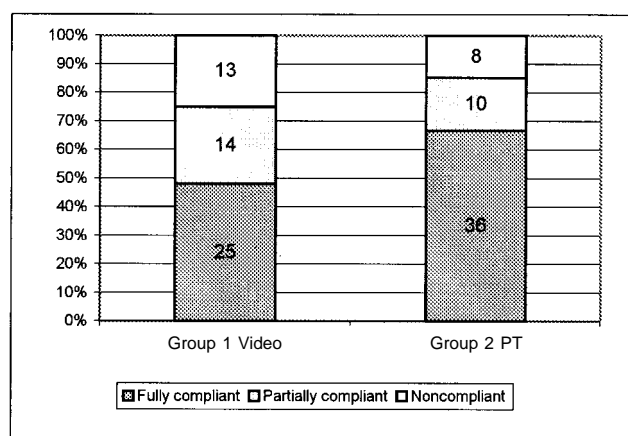


FIGURE 5. Compliance categorization by group assignment after 6 months of weekly participant self-reported compliance logs (video, video instruction; PT, physical therapy instruction).

TABLE 2. Results of a $4 \times 3 \times 2$ split-plot multiple analysis of variance (MANOVA) with time (4 levels), compliance (3 levels) and group (2 levels) as the independent variables; the dependent variable is the score on the Shoulder Pain and Disability Index (SPADI).

Independent Variables	F	df	Significance*
Time \times Compliance \times Group	0.656	6	$P = 0.685$
Time \times Group	0.654	3	$P = 0.583$
Time \times Compliance	1.782	6	$P = 0.109$
Group	0.537	1	$P = 0.466$
Compliance	0.414	2	$P = 0.663$
Time	74.321	3	$P < 0.0005$

* $\alpha = 0.025$.

TABLE 3. Results of a $4 \times 3 \times 2$ split-plot multiple analysis of variance (MANOVA) with time (4 levels), compliance (3 levels), and group (2 levels) as the independent variables; the dependent variable is the score on the University of Pennsylvania (UPenn) Shoulder Scale.

Independent Variables	F	df	Significance*
Time \times Compliance \times Group	1.174	6	$P = 0.325$
Time \times Group	0.358	3	$P = 0.784$
Time \times Compliance	1.296	6	$P = 0.265$
Group	0.043	1	$P = 0.837$
Compliance	0.017	2	$P = 0.983$
Time	86.156	3	$P < 0.0005$

* $\alpha = 0.025$.

DISCUSSION

Based on the SPADI and UPenn Shoulder Scale, our study found no differences in self-reported patient outcomes or compliance between 2 methods of home exercise program instruction. Our results support studies completed by Wong and Wong,²⁵ Pace et al,¹⁵ and Lawson et al,¹⁰ which found videotapes useful in postoperative rehabilitation programs and modifying dietary habits.

Several factors may explain why no differences were found between the 2 home exercise instruction groups or among the 3 levels of compliance in the 2 outcome measures. These include the lack of blinding of the patient and therapist to group assignment, power issues, escalating attrition rates, equal therapist contact, the use of compliance as an independent variable, and lack of generalizability. Each factor is discussed below.

Neither patient nor therapist was blinded to group assignment. Lack of patient blinding may have contributed to dissatisfaction with group assignment, thus influenced return rates for all phases of the study, self-reported outcomes, or compliance values. Lack of therapist blinding, however, probably had a minimal effect on patient outcomes, as the outcome measures used were all patient self-reported. Regardless, blinding of either or both entities would have added further clarity to the research results.

Post hoc power analysis was conducted to determine if an adequate number of subjects participated in the study and to establish that a clinically meaningful difference existed between the 2 groups. The research of Williams et al²⁴ evaluated the responsiveness of the SPADI to clinically relevant changes. Their research demonstrated that a change greater than 10 points was necessary to indicate a minimal level of clinically relevant change in a patient's shoulder status. No similar information was available for the UPenn Shoulder Scale. Using the 10-point difference in the SPADI, along with the median standard deviation value (15.9) of all of the SPADI scores across time (Table 1), we were able to evaluate whether we had a sufficient number of subjects to find a clinically meaningful change had one existed. Based on a 4-time-interval repeated-measures test with an average standard deviation in SPADI scores of 15.9, we calculated that 7 subjects per group would have been sufficient (calculated power value of 0.83) to find a clinically meaningful difference had one existed. Even after drop-outs, our sample size far exceeded 7 patients per group. We conclude, therefore, that our failure to reject the null hypothesis was not due to inadequate power. The SEM and 95% confidence interval values calculated for the SPADI in the study completed by Roddey et al¹⁷ further support using clinically meaningful changes for evaluating individuals over time. In the current study,

no differences in the average scores between groups were greater than 5.3 points on a scale of 0 to 100 for any of the 3 postoperative time intervals. In contrast, within-group changes over time all demonstrated greater than a 10-point change for each interval except the last (between the 24- and 52-week interval) (Figures 6 and 7). One possible explanation for the lack of change in the final interval is the lack of sensitivity of the SPADI and the UPenn Shoulder Scale. Cook and colleagues⁶ found that both these scales and other shoulder outcome scales were particularly insensitive to individual changes in persons with either high or low shoulder function.

The attrition rate for the study increased slightly over time. Group 1 retained 31 of the original 54 participants, demonstrating a 43% attrition rate for the year. Group 2's attrition rate was better, at 31%. Both were much higher than the 10% used in the a priori power analysis calculation. Reasons for the higher-than-anticipated attrition may include decreasing commitment to the program over time and reluctance of patients to incur the inconvenience and financial costs of attending scheduled appointments.

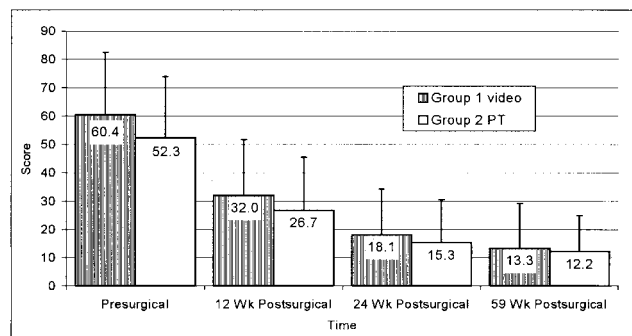


FIGURE 6. Means \pm standard deviation of presurgical, 12-week, 24-week, and 52-week scores on the Shoulder Pain and Disability Index (SPADI) for groups 1 and 2 (video, video instruction; PT, physical therapy instruction).

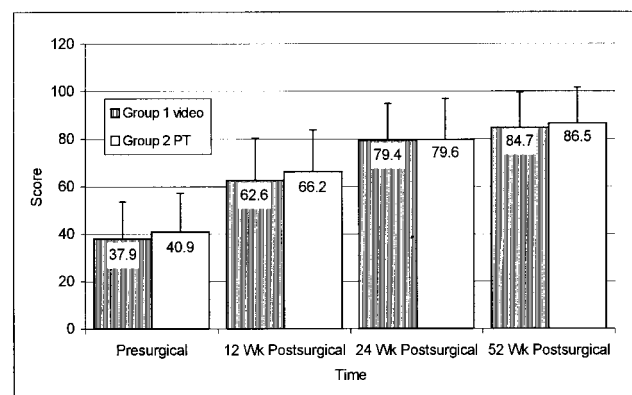


FIGURE 7. Means \pm standard deviation of presurgical, 12-week, 24-week, and 52-week scores on the University of Pennsylvania (UPenn) Shoulder Scale for groups 1 and 2 (video, video instruction; PT, physical therapy instruction).

Because we were unable to assess the outcomes of nonresponders, we cannot be certain that the outcomes of the responders and nonresponders were the same. Norquist et al¹⁴ completed a study that followed patients with rotator cuff repairs over time and classified each participant as either a responder or nonresponder. Results obtained from the nonresponders differed slightly from those obtained from the responders.¹⁴ They concluded that results from those who fail to complete their participation in a study cannot be assumed to be the same as results from those who continue to participate in the entire course of the study.¹⁴

Both groups had equal access to the physical therapist. This may have minimized the difference between the 2 groups' outcomes. Because it was felt by both the surgeon and therapist that all patient questions should be answered regardless of group assignment, participants in both groups were able to contact the therapist and have their concerns addressed directly. Had this contact not been available to group 1, their outcomes or compliance may have been different. Additionally, at the time of each physician appointment, the therapist also evaluated each patient, both those in group 1 and 2, for the appropriateness of progressing to the next phase of the rehabilitation program. Group 1 participants were sent home to view the tape and receive their instruction through that method; participants in group 2 received their instruction immediately during that visit. However, regardless of group assignment, some personal feedback was provided during the office visit, limiting the difference between the 2 groups.

The inclusion of compliance as one of the independent variables may have affected the study results. Participants were categorized into 1 of 3 compliance categories based on their self-reported compliance for 6 months after surgery. Fortunately, the largest attrition rate occurred at the 52-week session, and all but 17 persons were still actively involved in the project at 6 months. Therefore, all but those 17 were categorized based on patient data from the return logs, not on the lack of return logs. Additionally, the compliance measurement tool itself may have influenced the finding that compliance was not significantly associated with outcomes. This tool required patients to recall how much of their rehabilitation program they completed the previous week. It assumes that patients know which exercises were to be completed and are able to recall the degree to which they completed them. Failing to return a compliance log is not always an indication that the subjects were noncompliant with the program, only that they were noncompliant in returning the compliance logs. Unfortunately self-reported compliance is particularly vulnerable to such limitations.

These results have limited generalizability to other physical therapy clinics for 2 additional reasons. First,

in this study, the surgeon performed the FTRCT repair surgery using a fully arthroscopic approach. The more typical surgical procedure for this type of repair is a mini-open approach, which is a combination of arthroscopic and open techniques.¹ Secondly, the rehabilitation program for these patients may not be considered standard by other clinicians and physicians in terms of therapy frequency or inclusion of specific exercises.

This study utilized only self-reported pain and function outcome measures as tools to evaluate changes in participants' status. Neither physical performance tests nor impairment-based measures, such as range of motion or strength, were reported. Utilizing this information might have provided additional insight into participants' change in status over time.

CONCLUSION

Based on 2 self-report functional measures, the SPADI and the UPenn Shoulder Scale, the results of the current study suggest that videotapes can be an important patient education and instruction tool utilized during rehabilitation following arthroscopic rotator cuff repair surgery. We found no differences in overall self-reported outcomes of function during the first year between patients who received videotaped exercise instruction and those who received personal therapist-directed exercise instruction. Self-reported compliance with the home program appeared to have minimal effect on the overall outcome.

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Appendix A

Name: _____ Week Number: PRE 6W 12W 24W 52W
ID #: _____ Date of Surgery: _____

Shoulder Pain and Disability Index

Part I: Place a mark on the line to show how much PAIN you have had in the past week for each question

Example: No Pain _____ Worst Pain Imaginable

1. At its worst?

No Pain _____ Worst Pain Imaginable

2. When lying on the involved side?

No Pain _____ Worst Pain Imaginable

3. When reaching for something on a high shelf?

No Pain _____ Worst Pain Imaginable

4. When touching the back of your neck?

No Pain _____ Worst Pain Imaginable

5. When pushing with the involved arm?

No Pain _____ Worst Pain Imaginable

Part II: Place a mark on the line to show how much DIFFICULTY you have had in the past week to do the activity listed below.

1. Washing your hair?

No Difficulty _____ So Difficult
Required Help

2. Washing your back?

No Difficulty _____ So Difficult
Required Help

3. Putting on an undershirt or pullover shirt?

No Difficulty _____ So Difficult
Required Help

4. Putting on a shirt that buttons down the front?

No Difficulty _____ So Difficult
Required Help

5. Putting on your pants?

No Difficulty _____ So Difficult
Required Help

6. Placing an object on a high shelf?

No Difficulty _____ So Difficult
Required Help

7. Carrying a heavy object of 10 pounds (4.54 kg) or more?

No Difficulty _____ So Difficult
Required Help

8. Removing something from your back pocket?

No Difficulty _____ So Difficult
Required Help

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Appendix B

Name: _____ Week Number: PRE 6W 12W 24W 52W
 ID #: _____ Date of Surgery: _____

UPenn Pain and Satisfaction

Please circle the number closest to your level of pain or satisfaction:

Pain at rest with your arm by your side:										
0	1	2	3	4	5	6	7	8	9	10
No Pain Worst Pain Possible										
Pain with normal activities (eating, dressing, bathing):										
0	1	2	3	4	5	6	7	8	9	10
No Pain Worst Pain Possible										
Pain with strenuous activities (reaching, lifting, pushing, pulling, throwing):										
0	1	2	3	4	5	6	7	8	9	10
No Pain Worst Pain Possible										
Pain Score = /30										
How satisfied are you with the current level of function of your shoulder?										
0	1	2	3	4	5	6	7	8	9	10
Not Satisfied Very Satisfied										

Clinician Use only below this line

Range of Motion

	AROM		PROM		% Diff	Pt
	INV	UNINV	INV	UNINV		
Fwd Elev.						
ER at 0 abd.						
ER at 90 abd						
IR -thumb						
Total Points =						/40

Strength

Device:	INV	UN INV	% Dif	Pts
kg lb ft lb				
ER at side				
IR at side				
Abd. At 45 POS				
Total Points =				/60

UPenn Function Scale

Circle the number that best applies to your ability to
 3=no difficulty 2=some difficulty
 1=much difficulty 0=can't do at all
 X=didn't do before injury:

Reach the small of your back to tuck in your shirt with hand	3	2	1	0	X
Wash middle of back/hook bra	3	2	1	0	X
Perform necessary toileting activities	3	2	1	0	X
Wash the back of the opposite shoulder	3	2	1	0	X
Comb hair	3	2	1	0	X
Place hand behind head with elbow held straight out to side	3	2	1	0	X
Dress self (including put on a coat and pull off shirt overhead)	3	2	1	0	X
Sleep on affected side	3	2	1	0	X
Open a door with affected side	3	2	1	0	X
Carry a bag of groceries with affected arm	3	2	1	0	X
Carry a briefcase or small suitcase with the affected arm	3	2	1	0	X
Place a soup can (1-2#) on a shelf at shoulder level without bending elbow	3	2	1	0	X
Place a gallon container (8-10#) on shelf at shoulder level without bending elbow	3	2	1	0	X
Reach a shelf above your head without bending elbow	3	2	1	0	X
Place a soup can (1-2#) on a shelf above your head without bending elbow	3	2	1	0	X
Place a one gallon container (8-10#) on a shelf overhead without bending elbow	3	2	1	0	X
Perform usual sport/hobby	3	2	1	0	X
Perform household chores (cleaning, laundry, cooking)	3	2	1	0	X
Throw overhand, swim, or overhead racquet sports	3	2	1	0	X
Work full-time at regular job	3	2	1	0	X
Total Function =	/60				

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