Physical Therapy Utilization of Graded Exposure for Patients with Low Back Pain

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The Fear-Avoidance Model of Musculoskeletal Pain suggests that elevated pain related fear is a precursor to chronic low back pain. Recent prospective studies support the predictive validity of this model and treatment approaches based on the model have also been reported in the literature. Graded exercise/activity is one treatment approach that has been well described in the literature, with reports describing physical therapy specific application. Graded exposure is another intervention with the potential to reduce pain related fear, yet physical therapy specific application of graded exposure has not been widely described in the literature. The purpose of this clinical commentary was to provide information on the theoretical aspects of graded exposure, briefly review available evidence for graded exposure, and describe physical therapy application of graded exposure for 2 patients enrolled in a physical therapy clinical trial.

Level of Evidence: Level 5.

Key Words: *behavioral intervention, biopsychosocial, secondary prevention, fear-avoidance, disability, kinesiophobia*

Background

Psychological factors are commonly used to explain the development and maintenance of chronic low back pain (LBP).[39;40] In fact, individual studies suggest that psychological factors are stronger than physical and demographic factors for predicting LBP outcomes.[9;21] This clinical commentary focuses on the Fear-Avoidance Model of Musculoskeletal Pain (FAM) which was reviewed by Leeuw et al in 2007.[30] Briefly, the FAM proposes that the primary affective and cognitive components influencing pain perception are anxiety, pain-related fear (including fear of movement and re-injury), and pain catastrophizing.[49] These factors interact to determine the individual's initial behavioral response to acute pain, which occurs on a continuum from avoidance to confrontation. A confrontation behavioral response (associated with low levels of anxiety, fear, and catastrophizing) is hypothesized to be an adaptive response to pain as the likely consequences are return to normal vocation and social activities.[33] An avoidance behavioral response (associated with high levels of anxiety, fear, and catastrophizing) is consistent with increased attention to pain and is hypothesized to be a maladaptive response.[33] Long-term avoidance behavior has been hypothesized to have psychological (hyperalgesia and depression), physical (limitations in physical performance and disuse syndrome), and societal (chronic disability) consequences.[7;28;33;49]

The FAM was selected as the focus of this manuscript because the model appears to have clinical relevance for patients with LBP. Specifically, previous studies suggest that questionnaires based on the FAM accurately identify poor prognosis for patients with LBP.[1;19] Furthermore, effective LBP intervention strategies based on the FAM have been reported.[10;23;35;47] Theoretically, the common goal of FAM based interventions is to encourage a confrontation response in patients with LBP that normally would utilize an avoidance response. This clinical commentary focuses on the application of graded

exposure which is a FAM based intervention that potentially has application for physical therapists treating patients with LBP.

Graded exposure intervention encourages a confrontation response by exposing patients to specific situations of which they are fearful during rehabilitation.[47;48] Philips[38] originally suggested graded exposure as a treatment option for LBP because it provided the patient with direct experience that performing fearful activities will not necessarily cause further harm by damaging the spine. Patient education is another important part of graded exposure as it serves as a way to reduce pain related fear and threat associated with LBP, as well as to inform the patient on the potential problems associated with long term avoidance behavior. The actual exposure itself is done in a hierarchical fashion and the first step is to identify specific activities feared by the patient. These activities are started at a diminished level that elicits minimal amounts of fear, and then gradually increased to situations that elicit larger amounts of fear. As will be outlined later in this commentary, subsequent activity progression is based on fear ratings of the selected activities. Theoretically, successful application of graded exposure results in gradual and increasing exposure to fearful activities, and this exposure provides the patient with experiential evidence that the previously held negative beliefs were exaggerated. Ideally, this positive shift in beliefs results in improved functional performance and decreases the probability of developing chronic LBP.[30]

Graded exercise is **a behavioral intervention utilized by physical therapists**, and although not a focus of this commentary, graded exercise does serve as a good contrast for graded exposure. Graded exercise is consistent with the FAM because it encourages confrontation by improving patients' exercise or activity tolerance.[17] However, graded exercise progression is not based on what the patient is fearful of; instead it is based on whether the patient meets pre-determined quota levels set by the clinician. A few studies suggest that patients with LBP benefited when standard rehabilitation approaches were

supplemented with graded exercise[23;35] and a case report detailing physical therapy management of a patient with graded exercise has also been published.[22] Therefore, there appears to be adequate information to allow for clinical implementation of graded exercise by physical therapists.

In contrast, there is less information available for physical therapy implementation of graded exposure. LBP rehabilitation based on graded exposure principles is consistent with the FAM and there is potential for physical therapists to utilize graded exposure while treating patients with LBP, especially when elevated levels of pain-related fear are present.[30] Previous reports of graded exposure have been primarily in chronic pain settings, with treatment directed by psychologists.[47;48] To the best of our knowledge, physical therapy specific implementation of graded exposure has not been reported in the literature. Therefore, the purpose of this clinical commentary is to review the available evidence for graded exposure and describe physical therapy application of graded exposure for 2 patients enrolled in a clinical trial.

Evidence Supporting Graded Exposure

Evidence for application of graded exposure can be found from 2 sources of evidence. The first source is a series of single subject experimental designs involving within group comparisons for patients with wide spread chronic musculoskeletal pain.[13;47;48] In these studies, consecutive patients were treated with either graded exercise or graded exposure, and in general superior outcomes were associated with graded exposure for pain intensity, pain-related fear, and disability.[13;47;48] One of the interesting aspects of these studies is that when timing of graded exercise and graded exposure was varied, graded exposure was associated with larger improvements in pain related fear.[47;48] Furthermore, when education about exposure was compared to actual, *in vivo* graded exposure **(i.e. actually participating in exposure)**, graded exposure was necessary to observe increased activity.[13]

The second source of evidence for graded exposure is from 3 recently reported randomized trials that involved between group comparisons. In 2008, Linton et al[36] reported the results of a clinical trial that compared the effects of graded exposure plus usual care to a wait list control group. This trial included 46 patients with at least 3 months of activity restriction due to LBP and with elevated levels of pain related fear. Immediately after treatment, patients receiving graded exposure in addition to usual care had statistically larger improvements in function (effect size = .6), but not for pain intensity or pain-related fear. This study utilized a cross-over design and when the wait list control group received graded exposure, additional statistical improvements were observed for function and pain-related fear, but not for pain intensity.

In 2008, Leeuw et al[32] reported a trial that compared the effects of graded exercise and graded exposure. This trial included 85 patients with at least 3 months of LBP and with moderate levels of pain related fear. At the 6-month follow up the authors reported no statistically significant differences between graded exercise and graded expsoure for functional disability, main complaints, daily activity levels, or pain intensity. The authors did note some favorable trends for graded exposure, as it was associated with larger raw improvements in functional disability and main complaints, as well as statistically significant reductions in pain catastrophizing and perceived harmfulness of activities.[32] In a planned sub-group analysis, Leeuw et al[32] reported that the effects of graded exposure were equivalent for patients with elevated pain related fear.

In 2008, George et al[24] reported a trial that compared the effects of treatment-based classification physical therapy to treatment-based classification physical therapy augmented with graded exercise or graded exposure. This trial included 108 patients with 24 weeks or less duration of LBP and all levels of pain related fear. At the 6 month follow up the authors reported no statistically significant differences between the 3 groups for pain and disability outcomes. However, treatment based classification physical

therapy alone and augmented with graded exposure were associated with larger 6-month improvements in pain related fear in comparison to physical therapy augmented with graded exercise. In a planned sub-group analysis, George et al[24] reported that the effects of graded exposure were equivalent for patients with elevated pain related fear.

The available data from single subject studies[13;47;48] and randomized clinical trials[24;32;36] allow some tentative conclusions to be drawn regarding evidence for graded exposure. First, consistent evidence supporting use of graded exposure comes from single subject studies involving patients with chronic musculoskeletal pain conditions.[13;47;48] Second, there is some preliminary randomized trial evidence suggesting that for patients with chronic LBP graded exposure is superior to usual care while waiting to receive exposure[36] and weaker evidence suggesting graded exposure is superior to graded exercise.[32] Third, there is only 1 trial investigating graded exposure for individuals with acute and sub-acute LBP, and it suggests no additional benefit from graded exposure in addition to treatment based classification physical therapy.[24] Last, there is no evidence to suggest that patients with elevated pain related fear benefit more from graded exposure, in comparison to those with normal levels of pain related fear.[24;32]

Physical Therapy Application of Graded Exposure

The literature investigating graded exposure is small and obviously additional research is needed before definitive clinical recommendations can be made. However, the available evidence does suggest the potential for physical therapy application of graded exposure, and currently physical therapy specific examples of graded exposure are lacking in the literature. In this clinical commentary the application of graded exposure will be done by describing treatment details for 2 patients that participated in the previously mentioned George et al[24] clinical trial. **These particular patients were selected because**

they received their treatment from the same clinic and were both treated by the same physical therapist. Such details are not typically provided when randomized trials are reported and the information provided in this commentary may allow physical therapists to implement graded exposure in their clinical environment.

All patients enrolled in the clinical trial were evaluated using a previously described treatment based classification system for LBP[14] and because this system has been well described in the literature this clinical commentary will not provide details on that aspect of the patient encounter. Briefly, patients underwent a focused, standard examination of the musculoskeletal system that included select historical and physical factors consistent with current trends in treatment based classification (Table 1).[18] The examination allowed for consideration of directional preference of lumbar spine movements,[37] a preliminary clinical prediction rule for stabilization,[25] and a validated clinical prediction rule for manipulation.[11] Specifically, these 2 patients were found to have clinical signs associated with stabilization classification. Therefore, they were prescribed lumbar stabilization exercises used by Hicks et al[25] in addition to graded exposure.

Clinical assessment of patients in this trial also considered patient affect and cognition style consistent with the FAM.[30] Pain-related fear was quantified with 2 measures and the first was the Fear-Avoidance Beliefs Questionnaire (FABQ).[50] The FABQ was developed as a disease specific measure of patient beliefs regarding the effect of physical activity and work on LBP. The FABQ also assesses patient beliefs regarding re-injury and return to work.[50] Individual FABQ items are scored from 0 to 6 and the 4-item physical activity scale (FABQ-PA) has a total range of 0 – 24 while the 7-item work scale (FABQ-W) has a total range of 0 – 42. Separate consideration of the physical activity and work domains are recommended with higher scores indicating higher fear avoidance levels for both scales.[50] The FABQ has demonstrated adequate reliability and validity in previous studies.[29;44-46;50]

To implement graded exposure treatment, fear related to specific activities must be assessed, in addition to general pain related fear levels. Fear of specific activities was determined using an idiosyncratic clinical questionnaire, called the Fear of Daily Activities Questionnaire (FDAQ). The FDAQ lists 10 activities patients with LBP commonly report as being fearful of performing due to pain (Appendix). The FDAQ also has 2 options for open-ended responses so that patients with LBP can provide additional examples and ratings of activities that they fear performing due to pain. Patients rate each FDAQ item using a numerical rating scale (NRS) that ranges from 0 (No fear) to 100 (Maximal fear).

After the items are rated, the physical therapist then identifies items ranked as equal to or higher than 40/100 for implementation by graded exposure. This process is a modification of a previously reported method using photographs to select highly rated fear activities for inclusion in graded exposure treatment.[31] This modification was necessary because use of photographs was considered too time consuming for the clinical environment in which most physical therapists practice. It is important to note that while the FDAQ is utilized in our clinical setting for purposes of determining fear of activities, its psychometric properties have not been reported in the peer-review literature.

The 2 patients highlighted in this clinical commentary completed the FABQ and the FDAQ (Tables 2a and 2b). The FABQ scores were used to get a general indication of the levels of pain-related fear for these patients. In this particular clinical setting, the FABQ-PA was more appropriate for scoring because these patients did not have work-related injury. Although there is not a widely accepted threshold for determining "elevated" FABQ-PA scores, each of these patients exceeded the median score reported by Burton et al.[10] The FDAQ results were considered for decision making related to graded exposure intervention.

Patient #1 responded to the 10 standard FDAQ items, and did not provide any open-ended responses. The FDAQ showed variability in fear ratings of specific activities. The items corresponding to twisting (40/100) and reaching to the floor (50/100) had the highest fear ratings, and were considered for graded exposure treatment. Patient #2 responded to the 10 standard FDAQ items, and provided two open-ended responses, fear of walking up a steep hill and folding laundry while standing. Patient #2 also had variability in fear ratings and the open-ended responses corresponded with the highest pain ratings (60/100). These activities were considered for the graded exposure treatment. It was hypothesized that a decrease in self-report of disability and pain related fear would be associated with successful graded exposure treatment for these patients.

Intervention

Graded exposure was administered following suggestions provided from available studies[13;47;48] and reviews on the FAM.[30;49] One component of the treatment is to provide patient education that decreases fear and threat associated with LBP. Another component of the treatment is to implement activities that were rated as fearful under physical therapist supervision. In clinical situations these components are implemented simultaneously, but for clarity they will be described separately in this clinical commentary.

Pain related fear associated with LBP can be positively influenced by the type of information patients receive from their health care provider. The *Back Book*[43] is one way this information can be delivered. The *Back Book* provides current theory and evidence associated with the management of LBP in a factual, straight forward, and non-threatening manner. Key principles of the *Back Book* are summarized in Table 3 and randomized clinical trials using the *Back Book* have demonstrated that it effectively reduced FABQ scores, either alone[8;10] or in combination with physical therapy.[23] There is

also evidence to suggest that use of the *Back Book* is especially warranted for patients with elevated levels of pain related fear.[10;23]

Both patients described in this commentary were issued and asked to read the *Back Book* pamphlet. The physical therapist then assessed whether the pamphlet was read, and encouraged discussion of key principles from the *Back Book*. For example, Patient #2 had questions about why LBP is not always an indication of damage to the spine. This provided an opportunity for the physical therapist to review with the patient how radiological indicators of damage to the spine (i.e. herniated nucleus pulposus, intervertebral disc degeneration, spondylolisis, and spondylolisthesis) are common in patients with and without LBP.[4-6]

Progression or modification of this educational message does not typically occur during subsequent treatment sessions. Instead the physical therapist takes the opportunity to reinforce key principles from the *Back Book*. For example, Patient #1 had questions about why performing fearful activities would assist with his recovery. This provided an opportunity for the physical therapist to review the FAM with the patient, and indicate how continued avoidance of fearful activities could potentially result in the development of chronic pain and disability.

Graded exposure to activities rated as highly fearful were included in the treatment plan using parameters described in Figure 1.[24] During the first session, 2 highly rated activities from the FDAQ were introduced to the patient at intensities, frequencies, and durations that did not increase fear. This initial level of activity was determined through patient history or by having the patient perform the activity at a self-selected level that did not increase fear. Subsequent patient activity was progressed if decreased fear was reported following exposure to the fearful activity (Figure 1). When decreased fear of an activity was reported, the patient received positive reinforcement for confrontation. Then, the intensity, frequency, and/or duration of activity increased for the subsequent session. When maintained

or increased fear of activity was reported, the importance of attempting these activities was explained to the patient. Then, the activity exposure was maintained at the current intensity, frequency, and duration for the subsequent session. The decision to increase or maintain exposure levels is made from ratings that occur within the same treatment session (Figure 1), not in ratings that occur between treatment sessions.[24] Once fear levels are decreased, patients are also encouraged to expose themselves to these activities outside of the clinic, as part of the home exercise program. Although it should be noted that compliance to the home exercise program portion of graded exposure was not measured for these patients.[24]

Because it is not feasible to describe each treatment session for both patients only the first 3 graded exposure treatment sessions for Patient #2 are summarized (Table 4). The decision making process for the first 3 sessions of Patient #2 provide an adequate demonstration of the application of graded exposure treatment. These examples will allow readers to become familiar with typical decision making patterns involved with graded exposure treatment.[24]

Patient #2 used the open-ended questions of the FDAQ to indicate highly rated fearful activities for walking up a steep hill and folding laundry while standing (Table 2b). The fear of walking up a steep hill was initially rated by the patient at 60/100. The physical therapist used information from the patient history (walking time limit) and from having the patient walk on the treadmill in the clinic (incline level and walking speed) to determine initial activity level during Session #1 (Table 4). The patient performed the treadmill walking as suggested and reported post-activity fear rating of 10/100. At the conclusion of Session #1, the physical therapist planned to increase exposure time for the next treatment session. During Session #2, the patient rated pre-activity fear of walking up a steep hill at 20/100 (Table 4). Although this was an increase from the post-activity rating from Session #1(10/100), the therapist still increased the exposure time because the patient had previously noted a decrease during Session #1.

The patient completed 4 minutes on the treadmill as suggested and reported a post-activity fear rating of 30/100. At the conclusion of Session #2, the physical therapist planned to maintain the exposure level due to this increase in fear rating. Session #3 began with a pre-activity fear rating of 20/100. Again, even though this represented a decrease in fear from the post-activity rating from Session #2 (30/100), the previous exposure level was maintained because the patient had reported an increase in fear following the activity during Session #2. The patient completed the suggested walking activity in Session #3, and rated the post-exercise fear rating at 10/100. At the conclusion of Session #3, the physical therapist made a plan to increase the walking time and incline for Session #4. The graded exposure progression for inclined walking continued in a similar fashion until the patient was walking 10 minutes at 2.9 km/h and a 3.5% incline, with pre and post activity fear ratings of 0/100.

Folding laundry while standing was the second activity rated as highly fearful (60/100). After further questioning from the physical therapist it was determined there were 2 parts of this activity that caused the patient fear. The first part was lifting the basket when it was full of clothes, and the second part was standing in place to fold the laundry. Therefore, the physical therapist implemented both activities during the graded exposure treatment component. The physical therapist used information from the patient history (height of lift) and from having the patient practice lifts (weight of lift) to determine initial activity level during Session #1 (Table 4). The pre to post activity fear ratings decreased from 60/100 to 20/100 following Session #1. At the conclusion of Session #1, the physical therapist planned to increase exposure by increasing the number of repetitions and by adding a standing activity to the treatment program. During Session #2, the patient rated fear from folding laundry at 50/100 (Table 4). Anecdotally, the patient also reported some anxiety about performing the standing activity after the increase in lifting repetitions. Although this was an increase from the post activity fear rating from Session #1(20/100), the therapist still increased the exposure as planned from the decrease

during Session #1. The physical therapist acknowledged the patient's fear and anxiety, but also let the patient know that her fear and anxiety were the reasons for selecting these particular activities. The patient was able to perform the activities as prescribed during Session #2, and fear ratings were decreased from 50/100 to 30/100. At the conclusion of Session #2, the physical therapist planned to increase exposure by increasing the weight of the lift and by increasing the time of the standing activity. Session #3 began with a pre-exercise activity fear ratings of 30/100 and the patient was able to perform all the exposure related activity, with post-activity fear ratings of 10/100. This graded exposure progression for folding laundry while standing continued in a similar fashion until the patient was lifting 9.9 kilograms 15 times and doing standing activities for 15 minutes, with pre and post activity fear ratings of 0/100.

Outcomes

Standardized outcome measures were used to assess patient status before treatment, and then 4-weeks later.[24] Self-reported disability was assessed with the Modified Oswestry Disability Questionnaire (ODQ).[16] The ODQ has been found to have high levels of test-retest reliability, validity, and responsiveness[16;20;42] and is recommended as a primary outcome measure of self-report of disability for patients with LBP.[15] Pain intensity was assessed using a NRS ranging from 0-10 and the patient was asked to rate their current, worst (highest), and best (lowest) pain intensity ratings over the past 24 hours, and the mean of these ratings was reported in the clinical trial.[24] This method of pain assessment has previously demonstrated acceptable reliability and validity in the literature.[26;41] Although not commonly utilized as outcome measures, the FABQ and the FDAQ were also collected 4-weeks later.

Patient #1 had 4 treatments that occurred over the 4-week period and changes in status are summarized in Tables 2 and 5. The observed improvement in pain-related disability exceeded a published threshold for minimally clinically important difference (MCID).[20] The observed improvement

in pain intensity met the MCID threshold for 1/3 of the ratings.[12] Patient #1 also reported improvements in pain related fear and fear of activities included in the graded exposure program (twisting and reaching). Patient #2 had 9 treatments over the 4-week period, with improvements that exceeded the MCID for the modified ODQ[20] and met the MCID threshold for 2/3 of the pain intensity ratings (Tables 2 and 5).[12] Patient #2 reported improvements in pain related fear and fear of activities included in the graded exposure program (walking up a steep hill and folding laundry while standing). Patient #2 had larger improvements in pain related fear and fear of specific activities, in comparison to Patient #1. However, it is important to note that there are no accepted MCID's for the FABQ and FDAQ so determining the clinical relevance of these improvements is difficult.

An important issue is whether the 2 patients highlighted in this clinical commentary were representative of the graded exposure outcomes from the overall randomized trial. To address this issue, the 4-week disability and pain intensity outcomes for all patients receiving graded exposure were placed in a graph (Figure 2a and 2b).[24] The average 4-week change in the modified ODQ scale was 13.0 (sd = 14.8), so outcomes for Patient #1 were within 2 standard deviations of the mean and outcomes for Patient #2 were within 1 standard deviation of the mean (Figure 2a). The average 4-week change in average pain intensity was 2.7 (sd = 2.2), so outcomes for Patients #1 and #2 were within 1 standard deviation of the mean (Figure 2b). **Therefore, the patients highlighted in this commentary were representative of overall trial outcomes. However it should also be recognized that expected outcomes are likely to change based on initial levels of disability and fear. Furthermore, change in ratings for single patients must be viewed with caution as they do not control for measurement variation and non-specific effects. As with any treatment approach, variability in response to graded exposure is expected and only the randomized trial can provide a more definitive assessment of the effectiveness of the described approach.[24] The patients in this commentary were**

neither the best nor worse responders and were used only to provide an example of a standard approach to graded exposure, not to validate the effectiveness of graded exposure.

Conclusion

Graded exposure is a theoretically appropriate way to reduce chronic pain and disability within the FAM.[30] The primary goal of graded exposure is behavioral in nature, as it serves as a way to increase the performance of fearful activities. There are also important cognitive aspects of applying graded exposure that shouldn't be overlooked. Patients receive education that decreases the fear and threat associated with LBP. Also, patients receive positive reinforcement for performing fearful activities and utilizing beneficial coping strategies. Therefore it is impossible to separate the effects of the education and activity implementation components of the graded exposure treatment. In our opinion it is best to view graded exposure as a combined cognitive and behavioral treatment that encourages confrontation of fearful activities during rehabilitation of LBP.

Utilizing graded exposure may represent a philosophical shift in how physical therapists typically manage LBP. For example, the goal of patient education changes when using behavioral approaches. Instead of providing purely mechanical or anatomical explanations for causes and treatment of LBP, anatomical explanations of LBP are downplayed and use of adaptive coping strategies is encouraged. Furthermore, exercise prescription for LBP is typically based on physiological (muscle force production, range of motion, flexibility, or aerobic capacity), temporal (chronic or acute symptoms), or anatomical location (leg pain or no leg pain), parameters.[2;34] In contrast, exercise prescription for graded exposure is based on identifying fearful activities, systematically exposing the patients to these fearful activities, and progressing exposure to the activities when fear ratings decreased.[24;30;32;36]

Physical therapy practice guidelines allow for the assessment of psychological factors that influence rehabilitation outcomes, although such assessment is not commonly performed by clinicians.[3;27;34] The FAM is a specific theoretical model that provides guidance for clinicians to identify patients with elevated pain related fear and appropriately modify treatment. This clinical commentary described physical therapy utilization of graded exposure, which has not been widely reported in the literature. Given there is limited evidence currently available on graded exposure, additional research from prognostic studies and clinical trials is necessary to guide future clinical application of graded exposure for physical therapists. High priority items for future research in graded exposure include confirming whether graded exposure is superior to other behavioral interventions for chronic LBP and whether sub-groups of patients that will receive addition benefit from graded exposure can be accurately identified to allow focused application of the intervention.

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Table 1. Examination Findings and Treatment-Based Classification Determination

Examination	**Patient #1**	**Patient #2**
Duration of low back pain	84 days	18 days
Onset of low back pain	Sudden	Sudden
Symptom location	Low back and buttock	Low back and buttock
Prior history of low back pain	No	No
Lumbar movement testing		
Total flexion (degrees, symptom status)	20°, status quo	60°, status quo
Total extension (degrees, symptom status)	20°, status quo	10°, status quo
Left side bending (degrees, symptom status)	10°, status quo	22°, status quo
Right side bending (degrees, symptom status)	10°, status quo	20°, status quo
Qualitative assessment of lumbar flexion	Deviation present	Deviation present
Straight leg raise		
Right (degrees, symptom reproduction)	70°, negative	76°, negative
Left (degrees, symptom reproduction)	85°, negative	70°, negative
Bilateral active straight leg raise	Success	Success
Active sit up test	Unsuccessful	Success
Spinal tenderness	Present	Absent
Prone hip internal rotation		
Right (degrees)	25°	50°
Left (degrees)	25°	48°
Lumbar mobility	Hypermobile	Hypermobile
Prone instability test	Positive	Positive
Treatment classification	Stabilization	Stabilization

Table 2a. Fear of Daily Activities Rating Responses for Patient #1

Measure	**Initial Rating**	**4-Week Rating**
Fear-avoidance beliefs		
FABQ[a] physical activity scale score (0-24)	21	13
Sitting for longer than 1 hour[b] (0-100)	20	10
Standing for longer than 30 minutes[b] (0-100)	5	0
Walking for longer than 30 minutes[b] (0-100)	25	10
Lifting less than 9.1 kilograms[b] (0-100)	10	10
Lifting more than 9.1 kilograms[b] (0-100)	40	30
Carrying less than 9.1 kilograms[b] (0-100)	10	10
Carrying more than 9.1 kilograms[b] (0-100)	40	30
Twisting [b] (0-100)	***40***	***10***
Reaching to floor [b] (0-100)	***50***	***15***
Performing back exercises[b] (0-100)	10	5

[a] – Fear Avoidance Beliefs Questionnaire (FABQ)
[b] – Close ended item (range 0 – 100) from Fear of Daily Activities Rating Questionnaire (FDAQ)
[c] – Open ended item from Fear of Daily Activities Rating Questionnaire (FDAQ)
Bold and italic font indicates which activity was used for graded exposure treatment

Table 2b. Fear of Daily Activities Rating Responses for Patient #2

Activity	**Initial Rating**	**4-Week Rating**
Fear-avoidance beliefs		
FABQ[a] physical activity scale score (0-24)	19	1
Sitting for longer than 1 hour[b] (0-100)	50	0
Standing for longer than 30 minutes[b] (0-100)	50	0
Walking for longer than 30 minutes[b] (0-100)	60	0
Lifting less than 9.1 kilograms[b] (0-100)	20	0
Lifting more than 9.1 kilograms[b] (0-100)	40	5
Carrying less than 9.1 kilograms[b] (0-100)	20	0
Carrying more than 9.1 kilograms[b] (0-100)	40	5
Twisting [b] (0-100)	10	0
Reaching to floor [b] (0-100)	20	0
Performing back exercises[b] (0-100)	30	0
Walking up steep hill [c] (0-100)	***60***	***0***
Folding laundry while standing [c] (0-100)	***60***	***0***

[a] – Fear Avoidance Beliefs Questionnaire (FABQ)
[b] – Close ended item from Fear of Daily Activities Rating Questionnaire (FDAQ)
[c] – Open ended item from Fear of Daily Activities Rating Questionnaire (FDAQ)
Bold and italic font indicates which activity was used for graded exposure treatment

Table 3. Key Principles From *Back Book* Educational Pamphlet[43]

Category	Principle
"Abnormal" imaging findings	Very rarely a sign of serious disease Commonly found in people without low back pain
Implications of low back pain	No suggestion of permanent damage The spine is strong, even when it is painful Pain does not mean your back has serious damage
Treatment of low back pain	A number of treatments can help to control the pain Lasting relief depends on your effort Concentrate on maintaining and improving activity to restore normal function and fitness Utilize positive attitude and adaptive coping skills

Table 4.
Treatment Summary for Initial Graded Exposure Treatment Sessions (Patient #2)

Physical Therapy Session 1	**Physical Therapy Session 2**	**Physical Therapy Session 3**
Fearful activity #1 Walking up steep hill *Pre-activity fear level* 60/100 *Clinic activity* Treadmill walking x 3 minutes 3.0% incline, 1.9 kmh *Post-activity fear level* 10/100 *Fear reduced?* Yes *Plan* Progress exposure time *Fearful activity #2* Folding laundry *Pre-activity fear level* 60/100 *Clinic activity* Floor to table lift (4.5 kilograms x 10) *Post-activity fear level* 20/100 *Fear reduced?* Yes *Plan* Increase repetition and include standing time	*Fearful activity #1* Walking up steep hill *Pre-activity fear level* 20/100 *Clinic activity* Treadmill walking x 4 minutes 3.0% incline, 1.9 kmh *Post-activity fear level* 30/100 *Fear reduced?* No *Plan* Maintain exposure level *Fearful activity #2* Folding laundry *Pre-activity fear level* 50/100 *Clinic activity* Floor to table lift (4.5 kilograms x 12) Standing assembly activity (5 minutes) *Post-activity fear level* 30/100 *Fear reduced?* Yes *Plan* Increase lifting weight and standing time	*Fearful activity #1* Walking up steep hill *Pre-activity fear level* 20/100 *Clinic activity* Treadmill walking x 4 minutes 3.0% incline, 1.9 kmh *Post-activity fear level* 10/100 *Fear reduced?* Yes *Plan* Progress exposure time and incline *Fearful activity #2* Folding laundry *Pre-activity fear level* 30/100 *Clinic activity* Floor to table lift (6.8 kilograms x 10) Standing assembly activity (7 minutes) *Post-activity fear level* 20/100 *Fear reduced?* Yes *Plan* Increase repetition and standing time

Table 5. Summary of Outcomes Following Graded Exposure

Measure	Initial	4 Weeks
Patient #1		
Disability ODQ[a] (0%–100%)	50%	14%*
Average pain intensity (at present) Ordinal scale (0-10)	7/10	6/10
Pain (at worst) Ordinal scale (0-10)	7/10	6/10
Pain (at best) Ordinal scale (0-10)	5/10	3/10*
Patient #2		
Disability ODQ[a] (0%–100%)	46%	20%*
Pain intensity (at present) Ordinal scale (0-10)	4/10	2/10*
Pain (at worst) Ordinal scale (0-10)	8/10	3/10*
Pain (at best) Ordinal scale (0-10)	2/10	2/10

[a]ODQ = Oswestry Disability Questionnaire.

* - Improvement met criterion for minimally clinically important difference (6 points or greater on ODQ and 2 points or greater for pain ratings)

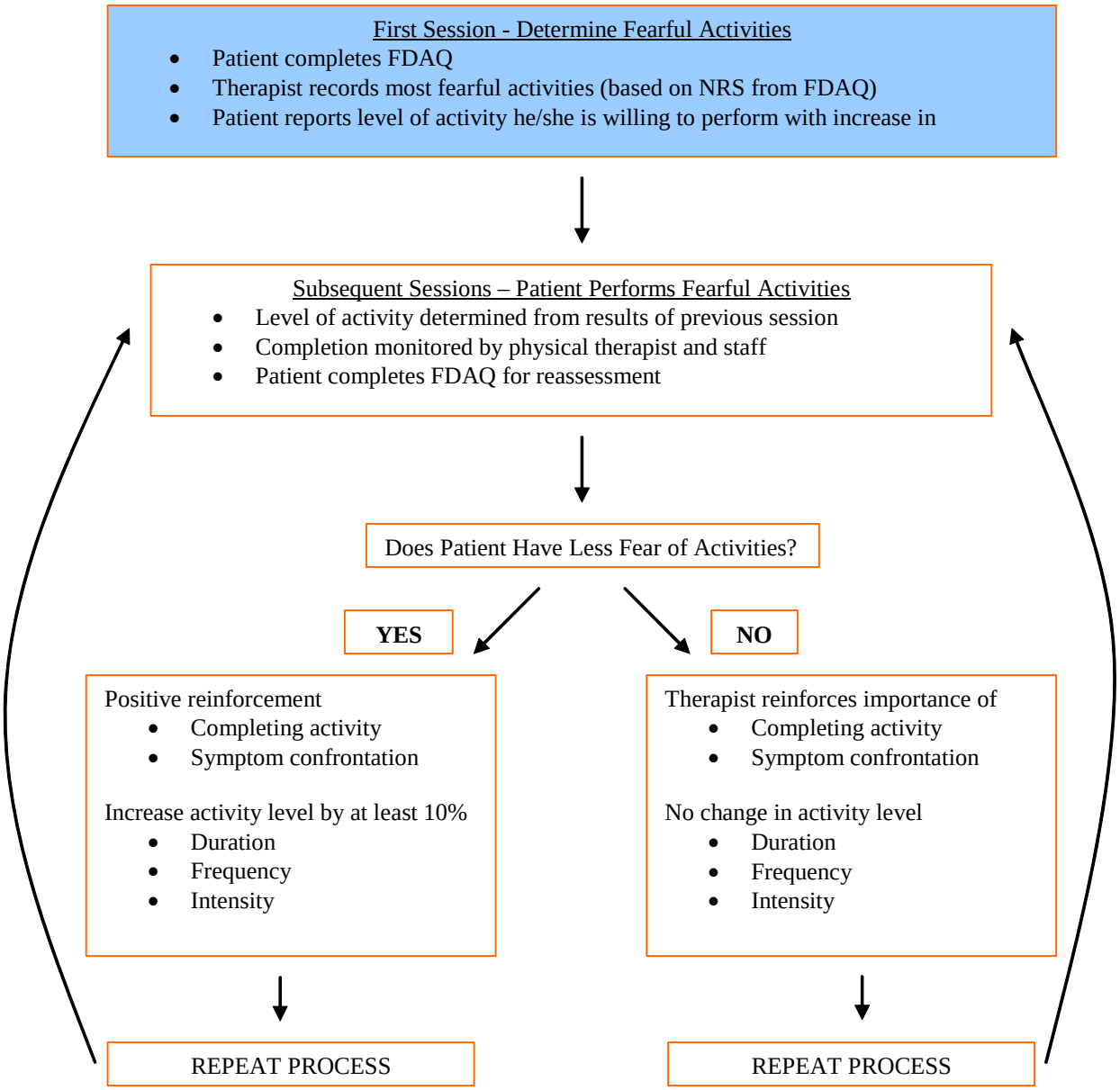
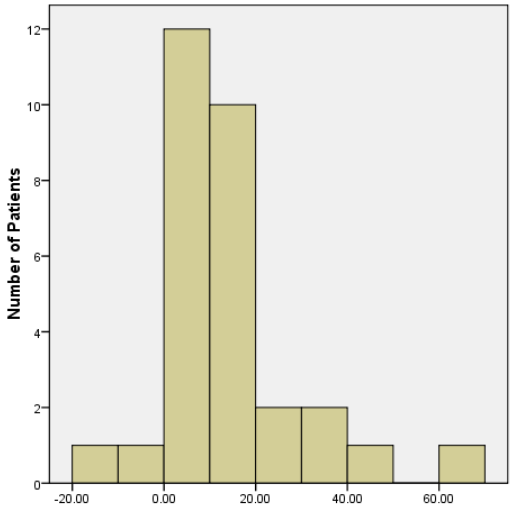


Figure 1. Decision Making Process for Graded Exposure Prescription



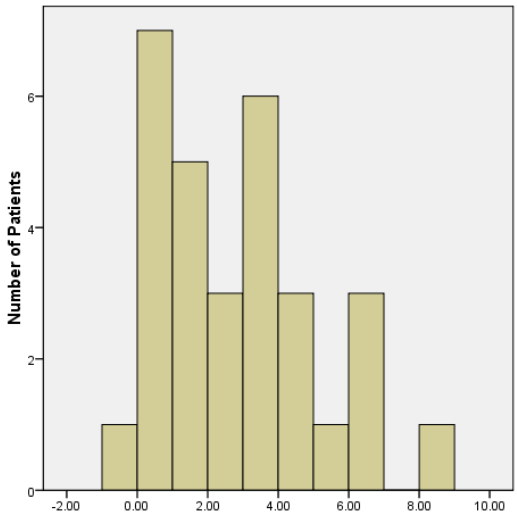


Figure 2a. Change in Disability Scores for Patients Receiving Graded Exposure Intervention in Physical Therapy Clinical Trial at 4-Weeks

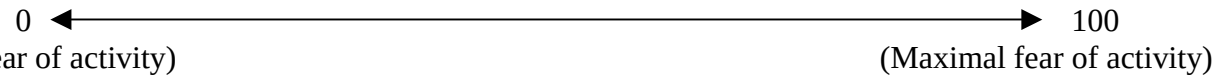
Figure 2b. Change in Average Pain Intensity Ratings for Patients Receiving Graded Exposure Intervention in Physical Therapy Clinical Trial at 4-Weeks

Appendix

Fear of Daily Activities Questionnaire (FDAQ)

People with low back pain have told us that they are fearful of performing certain activities because they believe these activities will cause additional low back pain, or re-injure their back.

Examples of such activities are listed below. Using the provided scale, please rate each activity for the amount of fear it causes you, as it relates to your low back pain. Because not all activities are fearful for all people, we are also asking you to list two different activities that cause you fear, and to rate the fear associated with those activities.



(No fear of activity) (Maximal fear of activity)

Activity	**Rating (0 – 100)**
1. Sitting for longer than 1 hour	_____
2. Standing for longer than 30 minutes	_____
3. Walking for longer than 30 minutes	_____
4. Lifting less than 20 pounds	_____
5. Lifting 20 pounds or more	_____
6. Carrying less than 20 pounds	_____
7. Carrying 20 pounds or more	_____
8. Twisting	_____
9. Reaching to the floor	_____
10. Performing back exercises	_____
11. _____	_____
12. _____	_____

Appendix Caption

The FADQ is a preliminary instrument with undocumented reliability and validity; therefore it should be used with caution in clinical settings. This instrument was included because it was an essential part of the decision-making process for implementation of graded exposure. Future studies will report psychometric information for the FADQ and this information will help to determine if the instrument is appropriate for widespread use.