



# The role of an integrated back stability program in patients with chronic low back pain<sup>☆</sup>

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## KEYWORDS

Therapeutic exercise;  
Chronic low back pain;  
Integrated back stability

## Summary

*Study design:* A controlled clinical trial.

*Objectives:* To assess the effects of an integrated back stability (IBS) programme on a chronic low back pain (CLBP) population in a time restricted private clinic environment.

*Background:* Studies assessing stability training CLBP have reported inconsistent results. Methods used within trials vary, with some authors focusing on muscle isolation and others using whole body movements. IBS uses an exercise progression beginning with posturally based exercise and progressing from muscle isolation through to complex movements.

*Methods and measures:* Fifty-nine chronic low back patients were divided into control ( $n = 32$ ) and intervention ( $n = 27$ ) groups. Participants in the intervention group were prescribed a 6 week individualized exercise programme in three stages. In stage 1, exercises addressed posture and movement dysfunction and activated the core stabilizing muscles. In stage 2, 'back fitness' was enhanced using progressive exercise principles. Stage 3 emphasized technique specific actions. Participants in the control group received a backcare advice leaflet only.

*Results:* Pre- and post-test scores were analysed for each of the outcome measures within the control group using a Wilcoxin signed ranks test. At an alpha level of  $p \leq 0.0071$ , no differences were observed. For the intervention group, a Mann–Whitney *U*-test showed significant differences between groups in the Roland and Morris Disability Questionnaire (RMDQ), short form McGill Pain Questionnaire (SF-MPQ), and the Tampa Scale of Kinesiophobia (TSK) ( $p \leq 0.0071$ ). Patient satisfaction was assessed by questionnaire, 89% of patients considering their level of pain and functional impairment acceptable following the programme.

<sup>☆</sup>This study was approved by Staffordshire University ethics committee.

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*Conclusion:* IBS significantly reduced pain and disability in the subject group studied. Patients reported a positive experience of the programme.  
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## Introduction

Chronic low back pain (CLBP) is seen in 85% of the population, with up to 80% of sufferers describing at least one recurrence.<sup>1</sup> Complementary therapies are used regularly in the management of this condition, with physiotherapy described as an 'orthodox alternative'<sup>2</sup> being a key treatment. Nine percent of CLBP sufferers will see a physiotherapist,<sup>3</sup> putting the cost of physiotherapy management in the UK at between £24 and £36 million annually.<sup>4</sup>

Exercise has been shown to be of value in the management of CLBP<sup>2,5</sup> with supervised exercise, now a key clinical recommendation.<sup>6</sup> Low load training of the abdominal and trunk muscles (stabilization training) is often the treatment of choice<sup>7,8</sup> with 51% of physiotherapists in the UK recommending this treatment in one study.<sup>9</sup> However, there is debate concerning the most effective programme for stabilization, with some authors favouring isolation of the anterolateral abdominal muscles and multifidus<sup>10</sup> and others using heavier load contraction of the quadratus lumborum.<sup>11</sup> A stability programme utilizing muscle isolation has been found to be as useful as spinal fusion surgery<sup>12</sup> and more effective than manual therapy or patient education when used as a component of musculoskeletal physiotherapy.<sup>13</sup>

Long term follow up following stabilizing exercises has shown a CLBP recurrence rate of 30% compared to 84% for a control group after 1 year and 35% compared to 75% after a 2–3 year follow up.<sup>14</sup> Both quality of life and functional outcomes have been shown to improve following stabilization exercise with CLBP patients.<sup>15</sup> Muscle isolation training has been criticized for its detrimental effect on motor control during trunk loading.<sup>16</sup> In addition, higher loads imposed on the trunk have been shown to increase trunk stiffness in a linear fashion.<sup>17</sup>

Other studies, however, have shown stability programmes to be no better than conventional physiotherapy (electrotherapy, manual therapy and advice)<sup>18</sup> or general fitness exercise.<sup>19</sup> These studies used 'endurance training for the deep abdominal and back extensor muscles'<sup>18</sup> and 'isolated lumbar stabilizing muscle training' progressing to 'integration of lumbar stabilizing

*muscle activity into light and then heavy dynamic functional tasks'*.<sup>19</sup>

Individuals exhibiting a sub-optimal posture report higher levels of pain.<sup>20</sup> As such, the use of posturally based exercise during a stabilization programme has been recommended.<sup>21</sup> Identification of patient sub-groups based on posture, aberrant movement patterns and physical tests has been described.<sup>22,23</sup> Postural sub-groups have been based on the original posture types described by Kendall et al.<sup>24</sup> expanded to consider symptom provocation due to postural strain. For example, in the 'flexion pattern' symptoms are provoked by a slouched sitting posture (lumbar flexion) and with the 'extension pattern' symptoms are provoked with overhead activities and other motions held in lumbar segmental hyperextension.<sup>25</sup>

Changes in tissue strain estimated from angular deformation during the activities of daily living (ADL) have been successfully altered as a result of a postural exercise programme<sup>26</sup> suggesting that inclusion of posturally based exercise may be of benefit during rehabilitation.

A stability programme which initially uses postural evaluation and muscle isolation but progresses to higher loading and technique specific movements has been described.<sup>7,27</sup> This programme, termed integrated back stability (IBS), draws together procedures (pain relieving modalities, exercise therapy and functional rehabilitation) from a variety of professional cross-boundary sources. The programme aims to simplify stabilization training and is based on training methods used in both therapy and sport which often follow a motor skill progression.

The aim of this study was to evaluate the effects of an integrated back stability programme on a CLBP population in a time restricted small private clinic environment.

## Methods

### Participants

Participants for the study were patients under the care of a private physiotherapy company in the UK. All were referred from their General Practitioner or consultant, had non-specific low back pain, and no

history of systemic disease. All patients gave full written consent as part of normal physiotherapy practice. The study was approved by the appropriate institutional ethical review committee.

## Study type

This was a controlled clinical trial, with measurement and rehabilitation instructions carried out by experienced musculoskeletal physiotherapists. The independent variables were the interventions, and the dependent variables questionnaires. To determine the efficiency of the IBS programme, 27 CLBP patients were included as subjects in the study. Thirty-two CLBP patients from the clinic waiting list formed the control group. All questionnaire-based data collection was blinded, with a clinical administrator handling the distribution and initial coding of questionnaire data. The clinical physiotherapists supervising the IBS programme were unaware of questionnaire results.

## Eligibility criteria

Participants were considered eligible for inclusion in this study if they were adults below the age of 55 (18–55 years), had a current medical diagnosis of CLBP, exhibited symptoms for longer than 3 months, and had symptoms located in the low back or buttocks. Participants were excluded if they had red flags suggesting serious spinal pathology (Waddell<sup>43</sup>), were pregnant, had a neurological deficit, or had an inability or unwillingness to complete the study questionnaires.

## Procedures

The control group received a general backcare advice leaflet only (Scriptographic Publications, Haslemere, UK), and were invited to continue physiotherapy management at the termination of the study. The intervention group underwent the IBS programme.

## Data collection

All participants within the intervention group underwent an initial examination by an experienced musculoskeletal physiotherapist. Descriptive data were collected (Table 1). Participants were also required to complete questionnaires at the beginning and end of treatment.

## Intervention group (IBS programme)

Patients in the intervention group attended for an initial musculoskeletal physiotherapy assessment lasting up to 60 min. During this time, posture was evaluated using a plumb line assessment described elsewhere.<sup>3</sup> Treatment was individualized by each clinician, following the programme outlined by Norris<sup>27</sup> (Appendix 1).

The IBS programme used in this study ran for 6 weeks. This time scale was dictated by the medical insurance companies referring subjects to the private clinic where the study took place.

In stage 1 of the programme, exercises were given to optimize posture. Where participants were hyperlordotic, exercises were used to increase the activity of the abdominal and gluteal muscles and lengthen the hip flexors, moving the participants into lumbar flexion and posterior pelvic tilt. Participants with hypolordosis received exercises which activated the erector spinae and moved the participants into spinal extension and anterior pelvic tilt. Survey has suggested that this type of programme is used by 70% of musculoskeletal clinicians prescribing lumbar-based postural exercise.<sup>26</sup> Pain relieving physiotherapy modalities including electrotherapy, joint mobilization and acupuncture were also used where pain was sufficient to limit or prevent exercise performance.

In stage 2, 'back fitness' was enhanced using graded (progressive) exercise principles.<sup>27</sup> Strength, flexibility, and endurance of the trunk and hip musculature were enhanced. Subjects progressed from stages 1 to 2 when their pain had reduced to a level where they no longer required pain relieving modalities, and they were able to

**Table 1** Descriptive data of participants.

	<i>n</i>	Gender	Age (year), mean (S.D.)	Height (cm), mean (S.D.)	Weight (kg), mean (S.D.)
Control group	32	Female ( <i>n</i> = 16), male ( <i>n</i> = 16)	36.9 (8.5)	167.4 (11.2)	71.3 (10.6)
Treatment group	27	Female ( <i>n</i> = 15), male ( <i>n</i> = 12)	37.5 (9.5)	168.7 (12.1)	69.6 (10.3)

demonstrate an abdominal hollowing action while maintaining a neutral lumbar posture.<sup>7</sup>

Stage 3 emphasized technique specific actions with the technique (bending, lifting, etc.) governed by the job/life activities of the patient. For sedentary individuals, manual-handling actions used in the home formed the basis of their exercise programme, while sportsmen and women used a gym-based programme which incorporated functional exercise actions. Subjects progressed from stages 2 to 3 when they were able to perform five repetitions of supine lying single leg lift while maintaining a neutral lumbar posture throughout the exercise performance.<sup>7,27</sup>

### Outcome measures

Outcome was based on self-reported pain, disability, cognitive status relevant to CLBP, and patient experience of the IBS programme. These items have been highlighted as the most relevant to clinical status in CLBP<sup>28</sup> and are tests used by others investigating core stability.<sup>19</sup> To maintain consistency with other CLBP studies, we chose commonly used tests. It has been argued<sup>29</sup> that back pain, as a multi-factorial condition, is best assessed using subjective (disability measure) rather than objective (laboratory tests) measures. Patient centred outcomes which derive from questionnaires have been shown to achieve acceptable levels of validity and reliability.<sup>30</sup> Many objective tests such as imaging or physical impairment (strength or range of motion), correlate poorly with symptoms and functional status.<sup>31</sup>

**Pain.** Pain perception was measured using the short form McGill Pain Questionnaire (SF-MPQ) a responsive scale giving both reliable and valid data.<sup>32</sup>

The SF-MPQ consists of three parts (I–III). The first (I) is a 15-point descriptor of average pain, with 11 points representing sensory experience (Ia) and four affective experiences (Ib). Each descriptor is rated on an intensity scale of 0–3, representing mild, moderate or severe pain, with ranges of 0–33 (sensory) and 0–12 (affective). The sensory and affective pain rating scores are added together to give a value for total pain experience (Ia+b).

The second part of the SF-MPQ (II) measures present pain intensity using a visual analogue scale (VAS) from 0 to 100 with higher scores representing worse pain. Total pain experience within the pelvic area only was assessed in the third part of the SF-MPQ (III) using a numerical pain rating from 0 (no pain) to 5 (excruciating pain).

**Disability.** Disability was assessed using the Roland and Morris Disability Questionnaire (RMDQ), an 18-item scale shown to be reliable and valid.<sup>33,34</sup>

The participant places a mark next to each appropriate statement and the total number of marked statements are added up and converted to a percentage.

**Fear of movement.** Fear of movement was measured using the Tampa Scale of Kinesiophobia (TSK) a valid and reliable measure when used with LBP patients.<sup>35</sup> The TSK consists of 17 statements scored on a four-point Likert scale from strongly disagree to strongly agree. The total score is calculated (after reversing the individual scores on questions 4, 8, 12 and 16). Total scores range from 17 to 68 with a higher score reflecting greater fear. A score of 37 is said to differentiate between high and low scores.<sup>36</sup>

**Patient experience.** To assess patient satisfaction with the IBS programme, a self-completed questionnaire was used which included a question to help determine patient acceptable symptom state (PASS).

The questionnaire format used a semantic differential scale (SDS), and a focus group of three practitioners involved in the study was used to determine the most appropriate questions for the SDS. The questionnaire (Table 2) comprised eight questions each using a seven-point bipolar rating scale with adjective opposites. A score of 7 indicated the maximum positive experience; a score of 1 the maximum negative. A score of 4.5 (the mid-point of the scale) indicated a neutral (neither positive nor negative) experience. Tick lines were used rather than numbers to avoid assigning a value to any attribute. Random polarity of attributes was chosen to avoid placing all positive or all negative attributes first and so causing a ripple effect.

Analysis of patient experience is an important method of assessing healthcare quality within physiotherapy.<sup>37</sup> A passive (bed rest and drug therapy) management approach to the treatment of LBP has been shown to score lower in terms of patient satisfaction than an active approach involving patient self-care.<sup>38</sup> An active therapy approach was emphasized in the present study.

### Statistical analysis

All analyses were performed using SPSS version 13.0 (SPSS, Inc., Chicago, IL). Pre- to post-differences within each group were calculated using the Wilcoxon test. An alpha level was accepted at  $p \leq 0.0071$  to account for multiple tests. Differences between groups were calculated using Mann–Whitney *U*-test. Effect size was calculated

according to the method highlighted in Rosnow and Rosenthal.<sup>39</sup>

For the SDS scale, the seven questions used were bipolar pairs represented by single lines. Scores 1–7

were attached to these for data analysis. Questions 1, 3, 5, and 7 placed the positive adjective first while questions 2, 4, and 6 placed the positive adjective last. The scores of questions 2, 4 and 6 were therefore reversed to match all questions. Mean values and standard deviations (S.D.) are shown in Table 4. Question 8 represented the PASS value and was answered as a yes/no value only. This is shown as the percentage of participants who found their current back health state acceptable (Table 4, end column).

**Table 2**

Audit of patient experience: Please tick ✓ your response

Q1. I found the exercise instructions:  
Easy to follow \_\_\_\_\_ hard to follow \_\_\_\_\_

Q2. As a result of the programme  
My back feels weaker \_\_\_\_\_  
My back feels stronger \_\_\_\_\_

Q3. As time went on  
The exercises got easier. \_\_\_\_\_  
\_\_\_\_\_ The exercises stayed the same.

Q4. Throughout the day I was  
Not more aware of my posture. \_\_\_\_\_  
\_\_\_\_\_ More aware of my posture.

Q5. As a result of the programme  
I am more confident about my back. \_\_\_\_\_  
\_\_\_\_\_ I am less confident about my back.

Q6. I found the exercises interfered with my daily work/life activities  
All of the time \_\_\_\_\_ Never \_\_\_\_\_

Q7. The exercise instructions were  
Clear \_\_\_\_\_ Not clear \_\_\_\_\_

Q8. Taking into account all your daily activities, your level of pain, and your functional impairment, do you consider that your current state is satisfactory?  
Yes  No

**Results**

Results are shown in Tables 1 and 3. No differences were observed in any of the outcome measures (pre- to post-) for the control group.

For the intervention group, significant differences were observed in the RMDQ, SF-MPQ (Ia, Ib, Ia+b, and III), and the TSK. Pre- and post-test scores—mean (S.D.) are shown in Table 3. Significant differences between groups (pre- to post-) are indicated by asterisk (\*).

Table 4 shows the results of each question on the patient audit. Mean values of all questions showed positive experience (>4.5 points), with the most positive being Q4 (5.6±0.56) ‘throughout the day I was more aware of my posture’ and the least positive being Q1 (4.9±1.3) ‘I found the exercise instructions easy to follow’. In addition, 24 of the 27 participants (89%) considered their level of pain and functional impairment acceptable after the intervention, indicated as the PASS Q8.

**Table 3** Comparison of clinical outcomes.

	Control N = 32			Treatment N = 27			p <sup>a</sup>	ES <sup>b</sup>	95% CI <sup>c</sup>	
	Pre Mean (S.D.)	Post Mean (S.D.)	p <sup>d</sup>	Pre Mean (S.D.)	Post Mean (S.D.)	p <sup>d</sup>				
SF-MPQ										
Ia	11.5 (8.5)	11.1 (7.7)	0.886	10.5 (7)	3.6 (3.9)	0.000*	0.000*	-1.20	-1.74	-0.63
Ib	3.3 (4.1)	3.3 (3.6)	0.056	3.1 (2.3)	0.6 (0.9)	0.000*	0.000*	-0.99	-1.52	-0.44
Ia+b	14.8 (12)	14.3 (10.7)	0.834	13.4 (8.1)	4.1 (4.5)	0.000*	0.000*	-1.21	-1.75	-0.63
II	36.6 (35.7)	36.2 (34.6)	0.217	52.3 (26.6)	13.5 (11.8)	0.000*	0.178	-0.85	-1.37	-0.30
III	2.7 (1.6)	2.7 (1.4)	0.460	2.9 (1.7)	0.7 (0.7)	0.000*	0.000*	-1.76	-2.34	-1.14
RDQ	13.0 (3)	13.0 (2.7)	0.763	9.5 (4.1)	2.3 (2.1)	0.000*	0.001*	-4.38	-5.25	-3.39
TSK	40.3 (11.5)	40.4 (10.9)	0.817	36.6 (7.4)	25.2 (9.4)	0.000*	0.000*	1.48	-2.04	-0.89

<sup>a</sup>p-value for between group comparison (Mann–Whitney).

<sup>b</sup>Effect size (from Rosnow and Rosenthal<sup>39</sup>).

<sup>c</sup>95% confidence interval for effect size.

<sup>d</sup>p-value for within group comparison (Wilcoxon).

**Table 4** Patient satisfaction and PASS outcome

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	PASS	
Mean	4.9	5.1	4.9	5.6	5.3	5.3	5.4	Yes	No
S.D.	1.1	1.0	1.0	0.6	0.9	0.8	0.6	24	3
Control	N/A	N/A							

N/A: not applicable.

## Discussion

The principle finding of this pilot study was that IBS was superior to a patient advice leaflet for treating patients with CLBP. However, these results should be interpreted with caution as a limitation of the study is the disparity in time and attention between the control group receiving a patient advice leaflet and the intervention group receiving the IBS programme. Further studies are required to compare IBS with other forms of therapy.

There are several approaches used to enhance back stability, broadly falling into two categories: muscle isolation and whole body training. Muscle isolation programmes emphasize the use of the transversus abdominis and multifidus muscles especially.<sup>8</sup> In some cases, authors argue that it is portions of these muscles which may need to be trained.<sup>40</sup> However, muscle isolation of this type is non-functional as it does not practice whole body movements normally used in daily living. In addition, some authors claim that conscious activation of the torso musculature degrades postural control.<sup>41</sup> Whole body training of the type used in popular weight training programmes can be modified for use in rehabilitation. This type of training, however, is often criticized on grounds of safety for CLBP patients, and for its tendency to focus on exercise quantity rather than quality.

The IBS programme attempted to form a bridge between these two approaches by applying rehabilitation principles traditionally used in the treatment of high-level athletes to CLBP patients. This type of integration was used in one of the pioneering studies in the late 1980s,<sup>42</sup> but for disc herniation alongside medical management. Since that time there has been a strong clinical emphasis within physiotherapy in the UK for muscle isolation and movement control alone, with the avoidance of higher load training. Our study was designed to show that integrating several aspects of trunk conditioning could successfully treat CLBP patients within a private practice environment under imposed time constraints.

The questionnaires used in the study emphasized the term pain. Consistent use of this term may be an

important social influence on the way in which a patient thinks and feels about their condition.<sup>43</sup> Strengthening beliefs about pain in this way can significantly contribute to the development of illness behaviour, and is contrary to current clinical guidelines for the physiotherapy management of CLBP.<sup>6</sup> In addition, some patients in the study found the TKS difficult to understand. Many of the sentences are long, and the patients' agreement or disagreement has to be converted to a numerical score (1–4), which some older patients found confusing.

Our programme lasted for 6 weeks; a timescale determined by the confines imposed by private treatment and medical insurance companies within the UK. Cairns et al.<sup>44</sup> used a 12-week stability programme, Scannell and McGill<sup>26</sup> a 12-week programme to alter posture, and Koumantakis et al.<sup>19</sup> an 8-week stability programme. Our 6-week rehabilitation period will only have been sufficient to gain neurogenic changes in muscle strength, myogenic changes taking longer than a 6-week period.<sup>45</sup> It seems likely therefore that the improvement seen in pain scores and disability are through changes other than muscle hypertrophy.<sup>43</sup>

Only 3 of the 27 participants in the intervention group (11%) failed to find their level of pain or functional impairment acceptable after the intervention. However, further analysis of these participants' details revealed that all three improved from their initial symptoms. It is uncertain whether these participants would find their symptoms acceptable following a longer period of rehabilitation.

No information was gathered regarding whether the control group found their treatment acceptable. This was thought unnecessary, as the aim of the SDS questionnaire was to audit patient experience of each aspect of the IBS programme. Questions 1–7 targeted specific features of the programme, and only question 8 considered PASS of overall treatment.

An SDS was used in this study, rather than a Likert scale. Both of these scales assess attitudes, but have different formats. The Likert scale uses a series of statements, which the participant then marks as strongly agree, partially agree, undecided, disagree, or strongly disagree. The SDS

simply involves marking a line between bipolar opposites, a method requiring less reading. It was felt that this scale was more appropriate to a busy private clinic situation providing a lower cognitive challenge to patients suffering pain and distress.

Although the SDS is an easily applied questionnaire, it assumes that the participant agrees with the question asked, and does not allow for other factors to be commented on. This could have been addressed by accompanying the questionnaire with an interview or focus group to gauge attitudes to the IBS programme. In addition, the question relevance could have been increased by involving participants in the initial focus group when structuring the SDS, to bring out adjectives chosen by the participants themselves. However, in the practicalities of a private clinic environment this was not considered feasible.

Some studies<sup>18,19</sup> have failed to show stability training to be more effective than general exercise for rehabilitation of the lumbar spine. Whilst the present study does not compare IBS with general exercise, it has shown it to be an effective method of rehabilitation when compared with an advice leaflet.

No differences were observed in any of the outcome measures (pre- to post-) for the control group in our study, a finding in line with others using similar control groups.<sup>15</sup> The nature of CLBP is that symptoms recur, and a study of lumbar stabilization training in CLBP using 'no intervention' as a control found participants to stay the same or get significantly worse.<sup>15</sup> Participants in our control group did not significantly change and this may be due to the administration of the backcare advice leaflet.

Some authors have found a patient educational booklet to give noticeable improvement in pain during the treatment of CLBP.<sup>46</sup> Our booklet was chosen because of its popularity within physiotherapy clinics. However, it was quite complex, containing 15 pages of information and gave only general advice. The booklet used by Udermann et al.<sup>46</sup> was individualized and subjects were motivated to read it by being tested on its content 1 week after reading it. It is possible that this approach may have improved the outcome scores of our control group.

Many studies assessing stabilization training focus closely on isolation of the deep abdominal muscles, often failing to progress these actions to more functional exercise. In a Cochrane review of functional rehabilitation of workers with back and neck pain, Schonstein et al.<sup>47</sup> assessed 18 RCTs. These authors recommended three components essential for successful rehabilitation; a physical conditioning programme, close association with work-related goals and outcomes, and correction

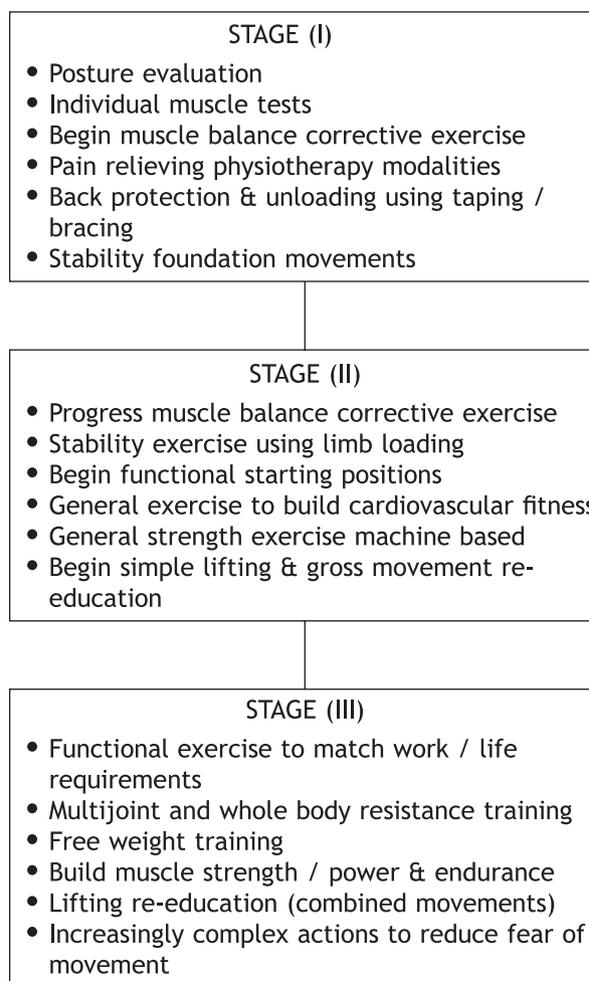
of dysfunctional beliefs. By using a three stage progression the IBS programme achieves these three aims rather than limiting itself to muscle isolation.

In previous studies, a four-point within-group change on the RDQ,<sup>48</sup> and a 2.5-point between-group difference has been considered clinically important.<sup>49</sup> In our study, mean values of RDQ changed from 9.5 (4.1) to 2.3 (2.1) a difference of 7.2. Of the 27 participants, 26 scored a greater than four-point change.

## Conclusions

The current study showed that, in the population studied, the IBS programme significantly reduced pain and disability as compared with that achieved by a back pain advice leaflet. Patients reported a positive experience of using the programme.

## Appendix 1. Integrated back stability programme model



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