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Adult Scoliosis And Chronic Low Back Pain With Land And Aquatic Based Physical Therapy: A Case Report

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2 **Department of Physical Therapy**
3 **PTH 608/708: Case Report Template**
4

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6 **Adult Scoliosis and Chronic Low Back Pain with Land and Aquatic Based Physical**
7 **Therapy: A Case Report**
8

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42 **Treatment of Adult Scoliosis and Chronic Low Back Pain with Land and Aquatic Based**
43 **Physical Therapy: A Case Report**

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57

58 The patient signed an informed consent allowing the use of medical information and photographs
59 for this report and received information on the institution's policies regarding the Health
60 Insurance Portability and Accountability Act.
61

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64 during the clinical practicum, and the patient for participating in this Case Report.
65

66 **ABSTRACT**

67 **Background and Purpose**

68 Scoliosis is commonly an idiopathic condition that occurs in approximately 2-3% of the
69 population and is defined by a lateral spinal curvature of greater than 10 degrees.^{1,2} Common
70 symptoms associated with scoliosis include decreased pulmonary function and chronic spinal
71 pain.¹ Depending on the degree of curvature bracing or surgery may be required.² The purpose of
72 this case study is to evaluate the effects of an aquatic and land based exercise program on an
73 adult with severe, untreated, early onset scoliosis.

74 **Case Description**

75 The patient was a 55-year-old female with a history of scoliosis and recent onset of low back
76 pain. The chief complaint was severe back pain, which limited her ability to function at her job
77 and impaired her ability to sleep. X-ray results showed severe scoliosis in the lumbar spine with
78 lateral subluxations at L3 on L4. The plan of care consisted of aquatic based therapy for lumbar
79 stabilization and decompression and land based therapy for soft tissue manipulation and lumbar
80 stabilization.

81 **Outcomes**

82 Throughout this plan of care, the patient's pain decreased from 4/10 to 0/10 at rest, 10/10 to 4/10
83 with prolonged activity, and 6/10 to 1-2/10 on average. The patient also demonstrated a
84 significant change in Oswestry Disability Index score from 28% to 10%.

85 **Discussion**

86 This case report suggested that aquatic and land based therapy that was focused on transverse
87 abdominis activation for lumbar stabilization, spinal decompression, and soft tissue manipulation
88 decreased our patient's low back pain and improved her functional mobility as evident by

89 improved pain scores and Oswestry Disability Index scores. Further research is suggested to
90 assess the long-term effects of aquatic and land based intervention.

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92 **Word count: 2,293**

93

94 **BACKGROUND and PURPOSE**

95 Scoliosis refers to a lateral curvature of the spine and is diagnosed when there is greater
96 than 10 degrees of spinal angulation in the frontal plane with spinal torsion.^{1,2} Most frequently
97 the cause of scoliosis is idiopathic, however, potential other etiologies may include
98 neuromuscular, congenital, neurofibromatosis, or syndrome related.^{1,2} The incidence of
99 idiopathic scoliosis is 2 – 3%, with the incidence of curvatures greater than 40° being less than
100 0.1%.² Although scoliosis does not affect a large population, it can be debilitating to those it
101 impacts.

102 Patients with idiopathic scoliosis may present with no symptoms, however, in more
103 severe cases symptoms include decreased pulmonary function and spinal pain. Due to the
104 severity of these symptoms, the purpose of conservative treatment is to decrease the progression
105 of the curvature. Depending on the degree of curvature, outpatient physical therapy with focus on
106 targeted exercise and a home exercise program may be appropriate. In adolescents with a Cobb
107 angle of greater than 25 degrees, physical therapy and bracing may be required to prevent a
108 further progression of the curvature.² At the time of this case report there was limited research
109 that showed long term effects of physical therapy intervention for patients with idiopathic
110 scoliosis.

111 Surgery may be required when conservative therapy does not cease the progression of
112 scoliosis. Surgery is typically indicated if the patient presents with a Cobb angle of greater than
113 45 degrees.³ Typical surgical intervention includes posterior fusion of associated spinal levels.³
114 The current limitations with surgical intervention is the need for repeated surgeries to lengthen
115 the placed rods as a child grows. In recent cases of early onset scoliosis, magnetic controlled
116 growth rods have been implemented (MCGRs).⁴ MCGRs are surgically placed and do not require
117 repetitive surgeries to lengthen as a child grows resulting in less complications secondary to
118 surgery.⁴

119 Currently, much of the research for the treatment of scoliosis is in relation to
120 adolescent's. However, as our population ages, more adult and elderly patients are presenting
121 with scoliosis that was not treated when they were adolescents. Due to patient age and possible
122 comorbidities, surgical correction is not always an option, leaving individuals of this population
123 with chronic back pain and possible respiratory impairments. The purpose of this case study is to
124 evaluate the effects of an aquatic and land based exercise program on an adult that presented
125 with severe, untreated, early onset scoliosis.

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128 **CASE DESCRIPTION**

129 **Patient History and Systems Review**

130 The patient was a 55-year-old female with a history of scoliosis and recent onset of low
131 back pain. Her chief complaint was severe back pain, which limited her ability to function at her
132 job and impaired her ability to sleep at night. The patient attended a pain clinic where she was
133 given muscle relaxers and had an x-ray. The x-ray results showed severe dextroconvex scoliosis
134 at L2, right lateral subluxations of L3 on L4, lower thoracic ankyloses, severe mid lumbar disc

135 space narrowing with associated degenerative sclerosis with moderate upper and lower disc
136 space narrowing. She was then referred to outpatient physical therapy to be evaluated and treated
137 for low back pain. A history of severe scoliosis and use of Milwaukee brace during childhood
138 and adolescence was reported by the patient. The pain at evaluation was described by the patient
139 as, “constant in my low back and tends to increase throughout the day and progress as a burning
140 sensation in my hips and legs by the end of the day.” The patient further reported a history of
141 gastroesophageal reflux disease that was treated with medication. The patient had no other past
142 medical history. The patient’s goals were to be able to work throughout the day with tolerable to
143 no low back pain and to be able to sleep throughout the night without back pain. See table 1 for
144 full systems review. The patient signed a consent form to participate in this case report.

145

146 **CLINICAL IMPRESSION 1**

147 Based on the patient’s subjective history and system review it was expected that the
148 patient would present with low back pain, radicular pain in lower extremities, and muscle
149 weakness. Furthermore, it was expected that the severity of the patient’s scoliosis would limit her
150 ability to stand for an extended period of time, ambulate on uneven surfaces, and work an eight-
151 hour shift at her job as a sales associate at a hardware store. Examination goals included
152 objective measures such as, the SLUMP test,⁵ range of motion (ROM),⁵ manual muscle testing
153 (MMT),⁵ postural assessment,⁵ numerical pain rating scale (NPRS),⁶ and Oswestry Disability
154 Index (ODI).⁵

155 This patient was a good candidate for a case report due to the complexity and severity of
156 her condition. In similar patient situations, the common approach was surgery, however this
157 patient had elected to not receive such intervention. Because surgery is the common approach to

158 this patient population there was limited research on physical therapy intervention for severe
159 adult idiopathic scoliosis.

160

161 **EXAMINATION – TESTS AND MEASURES**

162 The NPRS is performed by asking the patient to rate their pain on a 0-10 scale with 0
163 indicating no pain and 10 indicating severe pain.⁶ The minimal detectable change (MDC) for this
164 assessment was 3 points (27%) and the minimally clinically important difference (MCID) was 1
165 point. This assessment has also been shown to have excellent interrater/intrarater reliability
166 (100%), criterion validity ($r=.86$ when compared to visual analogue scale), and construct validity
167 ($r=.94$ when compared to visual analogue scale).⁷ The patient reported pain on the NPRS as a
168 4/10 at rest, 10/10 with prolonged activity, and 6/10 on average.

169 The ODI was performed to assess the impact of the patient's low back pain on their daily
170 function. The ODI has a MDC of 12.72 for patients with chronic low back pain as well as MCID
171 of 12.8. The ODI was also found to have a specificity of 85% and sensitivity of 88%.⁸ Results
172 from the ODI were 28% at evaluation.

173 Active range of motion (AROM) of the spine was assessed in standing.⁵ The patient
174 performed forward flexion, extension, and lateral flexion. AROM assessment showed significant
175 decrease in range of motion with extension, and lateral flexion and only minor decrease in
176 forward flexion. Numerical ranges were not assessed at evaluation due to lack of required
177 equipment. Due to no numerical measurements being taken, there was no reported statistical
178 reliability or validity, however, range of motion assessment is considered a standard practice for
179 physical therapists.

180 Manual muscle testing (MMT) was performed to assess the strength of bilateral hip
181 flexion, knee flexion, knee extension, plantar flexion, and dorsiflexion as described in Magee⁵.
182 The above MMTs were found to be within functional ranges. Abdominal strength was not
183 assessed due to patient's pain and inability to lay supine. MMT has been shown to have strong
184 interrater reliability with an intraclass correlation coefficient (ICC) of 0.94.⁹

185 Postural assessment showed significant deformities secondary to scoliosis as well as
186 severe thoracic kyphosis, significant cervical extension, a right lateral lean, elevated left iliac
187 crest, and elevated left scapula. Despite significant postural deformities, the patient did not
188 present with a leg length discrepancy or antalgic gait pattern. Although there is limited statistical
189 evidence to support an observational postural assessment, it is considered a standard assessment
190 of physical therapists as described in Magee.⁵

191 The SLUMP test was used to assess for any nerve root compression. The SLUMP test has
192 strong inter-tester reliability, kappa coefficient of .71, sensitivity of 100% and specificity of
193 83%.¹⁰ Results from the SLUMP test indicated no nerve root compression. Refer to Table 2 for
194 complete results of tests and measures.

195

196 **CLINICAL IMPRESSION 2**

197 Based on the examination data, signs and symptoms were consistent with the initial
198 impression of severe scoliosis and chronic low back pain. The patient continued to be
199 appropriate for this case report due to the complexity of her diagnosis, motivation and adherence
200 to previous physical therapy, duration of current condition, and age. The patient was given a
201 medical diagnosis of scoliosis (ICD-10: M41.9) and chronic low back pain without sciatica (ICD
202 -10: M54.5).¹¹

203 Based on clinical experience, the prognosis for this patient was favorable for reducing
204 symptoms of low back pain, however, physical therapy intervention for idiopathic scoliosis in
205 adults had not been thoroughly research at the time of this case report. This patient had a
206 favorable prognosis for reducing symptoms due to their previous level of function, history of
207 positive results from physical therapy intervention, and motivation to improve current condition.

208 The plan for this patient was to alternate between aquatic and land based therapy for 45
209 minute sessions, twice a week, for ten weeks. If no progress was made, the plan was to refer to a
210 surgeon to assess and provide possible surgical options to correct the scoliosis. No further
211 assessment was required at this time. The patient was to receive re-examinations every 5-weeks
212 to assess progress using the ODI and NPRS. The plan for intervention included aquatic therapy
213 with a focus on deep water traction, and water resisted exercise. The plan for land based
214 intervention included soft tissue manipulation and lumbar stabilization exercises. Refer to table 3
215 for short term and long term goals.

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INTERVENTIONS

Coordination, Communication, Documentation

221 Patient communication included development and instruction of home exercise program
222 (HEP), education on plan of care, and on clinical examination findings. The patient’s HEP was
223 reviewed or updated at every physical therapy session. The patient’s evaluation and treatment
224 notes were documented on an electronic medical record system (EMR) that was shared with the
225 referring physician.

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228 **Patient Related Instruction**

229 The patient was educated on their impairments and their plan of care. A HEP, given to
230 the patient on the first day (Appendix 1), included pictures of each exercise as well as written
231 instructions on exercise performance, duration, and frequency. The patient verbally and
232 physically demonstrated good understanding and adherence to the HEP throughout the entire
233 duration of physical therapy.

234

235 **Treatments**

236 Physical therapy interventions consisted of 45-minute sessions twice per week for 10 weeks.
237 It was determined that sessions would be split between aquatic and land based therapy. Due to
238 patient progression, aquatic therapy was performed twice per week for 4 weeks. Table 4 provides
239 details on each treatment session. Aquatic therapy was chosen based on evidence that supports
240 aquatic therapy in the treatment of low back pain.^{13,14} A typical progression for aquatic based
241 sessions were:

- 242 1. Subjective assessment of the patient's pain and progression since the previous session.
- 243 2. Shallow end ambulation for 3 minutes.
- 244 3. Shallow end side steps for 3 minutes.
- 245 4. Shallow end hip flexion (marching motion) for 3 minutes.
- 246 5. Deep end hang for 3 minutes.
- 247 6. Deep end hip flexion (marching motion) for 2 to 3 minutes.
- 248 7. Deep end walk for 3 minutes.
- 249 8. Deep end straight leg hip flexion/extension (scissor kick) for 3 minutes.
- 250 9. Repeat once.

251 Deep end exercises were performed with the use of foam floatation tubes in 6 feet of water.

252 A plan was developed after 8 consecutive aquatic treatment sessions to progress patient back
253 to land based treatment sessions. This decision was based on research that supported TA
254 activation and soft tissue mobilization for the treatment of low back pain.^{12,15} Exercise
255 progression was limited due to the patient's inability to lay supine and frequent aggravation of
256 their low back pain. A typical progression for land based sessions were:

- 257 1. Subjective assessment of the patient's pain and progression since the previous session.
- 258 2. NuStep (NuStep LLC, Ann Arbor, MI) at level 4 resistance, for 10 minutes.
- 259 3. Soft tissue manipulation (STM) of bilateral lumbar paraspinals from L1 to L5 for 15
260 minutes.
- 261 4. Seated hip flexion with bilateral shoulder flexion with cues on TA activation for 10
262 repetitions.
- 263 5. Bilateral standing row with red resistance band for 15 repetitions.
- 264 6. Seated hamstring stretch with two 30 second holds.

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266 **OUTCOME**

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268 Test and measures were performed by the same therapist at discharge and initial
269 examination (Table 2). Upon completion of physical therapy, the patient had improved
270 functional capability as shown by a change in ODI score from 28% at initial evaluation to 24% at
271 week 5 to 10% at discharge. She also demonstrated decreased pain according NPRS with change
272 in average pain from 6/10 to 1-2/10. Lumbar range of motion and lower extremity strength
273 remained unchanged throughout physical therapy. Furthermore, there was no change in the
274 patient's posture upon re-exam or discharge. The patient reported significant increase in daily

275 activities such as gardening, playing with her granddaughter, and her ability to work an eight-
276 hour shift with only mild back pain.

277

278 **DISCUSSION**

279 This case report described the physical therapy management of an adult patient with
280 severe idiopathic scoliosis. The patient performed an aquatic and land based exercise program in
281 conjunction with deep water traction and soft tissue manipulation. These interventions were
282 based on the current literature and clinical reasoning. Results from this case report suggest that
283 although physical therapy intervention may not change the degree of scoliosis, it may be able to
284 improve a patient's lumbar pain and functional mobility.

285 The outcomes of this case report were consistent with the initial hypothesis that lumbar
286 stabilization exercises and aquatic lumbar traction would decrease the patients low back pain.
287 This was based on research that supported the use of aquatic therapy,^{13,14} soft tissue
288 manipulation, and lumbar stabilization for the treatment of low back pain.^{12,15} Although this case
289 report had positive outcomes, it is unclear which interventions most contributed to the positive
290 results. Further research on adult patients with scoliosis is important because current studies are
291 primarily based on young children and adolescent populations. This is a problem because there
292 are many adult patients with low back pain, secondary to scoliosis, that were never treated when
293 they were a child. Further research would help determine best practice for this patient population,
294 and develop intervention protocols for adult patients with low back pain secondary to scoliosis.

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342 **TABLES and FIGURES**

343 **Table 1. Systems Review**

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Systems Review	
Cardiovascular/Pulmonary	Unimpaired
Musculoskeletal	Significant decreased lumbar and thoracic lateral flexion, extension, and rotation. Minimal decrease in lumbar and thoracic flexion. Gross upper and lower extremity strength within functional limits.
Neuromuscular	Bilateral burning sensation through buttock and posterior thigh
Integumentary	Unimpaired
Communication	Unimpaired
Affect, Cognition, Language, Learning Style	Unimpaired

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357 **Table 2. Tests and Measures**
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TESTS & MEASURES	INITIAL EVALUATION	RE-EXAM	DISCHARGE
Lower Extremity Manual Muscle Test	Within Functional Limits	Within Functional Limits	Within Functional Limits
Active Range of Motion: Lumbar/Thoracic Spine	Decreased flexion, extension, and lateral flexion	Decreased flexion, extension, and lateral flexion	Decreased flexion, extension, and lateral flexion
Numerical Pain Rating Scale Resting: Highest: Average:	4/10 10/10 6/10	2/10 6/10 4/10	0/10 6/10 1-2/10
Postural Assessment	Spinal deformity secondary to scoliosis, thoracic kyphosis, cervical extension, elevated left iliac crest and left scapula.	Spinal deformity secondary to scoliosis, thoracic kyphosis, cervical extension, elevated left iliac crest and left scapula.	Spinal deformity secondary to scoliosis, thoracic kyphosis, cervical extension, elevated left iliac crest and left scapula.
Oswestry Disability Index	28%	24%	10%
Slump Test	Negative	Negative	Negative

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364 **Table 3: Short Term and Long Term Goals**

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Short term goals: <ol style="list-style-type: none">1. Patient will decrease average low back pain to 3/10 on the NPRS in 4 weeks.2. Patient will improve ODI score to less than 25% in 4 weeks.3. Patient will improve body mechanics in order to safely lift objects at work without causing increased back pain in 4 weeks.
Long term goals: <ol style="list-style-type: none">1. Patient will decrease worst low back pain to 5/10 on the NPRS in 8 weeks.2. Patient will improve ODI score to less than 15% in 8 weeks.3. Patient will be able to work through an entire 8-hour shift with tolerable low back pain in 8 weeks.

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383 **Table 4. Treatment Session Timeline**
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Intervention:	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Seated hip flexion with TA activation	3 sets 10 reps		3 sets 10 reps		
Standing row with red resistance band	3 sets 10 reps		3 sets 10 reps		
Seated hamstring stretch	2 sets 20 sec hold		2 sets 20 sec hold		
STM to lumbar paraspinal L1-L5	10 min		10 min		
NuStep	2 resistance 10 min		2 resistance 10 min		
Shallow end ambulation		3 min x 4		3 min x 3	3 min x 2
Shallow end side step		3 min x 3		3 min x 2	3 min x 2
Shallow end hip flexion				3 min x 2	3 min x 2
Deep end hang		3 min x 5		3 min x 4	3 min x 4
Deep end scissor kick				3 min x 2	3 min x 2
Deep end hip flexion		3 min x 3		3 min x 2	3 min x 2
Deep end walk					3 min x 2
Intervention:	Treatment 6	Treatment 7	Treatment 8	Treatment 9	Treatment 10
Seated hip flexion with TA activation					

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Standing row with red resistance band					
Seated hamstring stretch					
STM to lumbar paraspinal L1-L5					
NuStep					
Shallow end ambulation	3 min x 2	3 min x 3	3 min x 2	3 min x 2	3 min x 2
Shallow end side step	3 min x 2	3 min x 2	3 min x 2	3 min x 2	3 min x 3
Shallow end hip flexion	3 min x 2	3 min x 2	3 min x 2	3 min x 2	3 min x 2
Deep end hang	3 min x 4	3 min x 3	3 min x 3	3 min x 3	3 min x 3
Deep end scissor kick	3 min x 2	3 min x 2	3 min x 2	3 min x 2	3 min x 2
Deep end hip flexion	3 min x 2	3 min x 2	3 min x 2	3 min x 2	3 min x 2
Deep end walk	3 min x 2	3 min x 2	3 min x 3	3 min x 2	3 min x 2
Intervention:	Treatment 11	Treatment 12	Treatment 13	Treatment 14	Treatment 15
Seated hip flexion with TA activation			3 sets 10 reps		
Standing row with red resistance band			3 sets 10 reps		
Seated hamstring stretch			2 sets 20 sec hold		
STM to lumbar paraspinal L1-L5			10 min		
NuStep			3 resistance		

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			10 min		
Shallow end ambulation	3 min x 2	3 min x 2		3 min x 3	3 min x 2
Shallow end side step	3 min x 2	3 min x 2		3 min x 2	3 min x 2
Shallow end hip flexion	3 min x 2	3 min x 2		3 min x 2	3 min x 2
Deep end hang	3 min x 4	3 min x 4		3 min x 4	3 min x 4
Deep end scissor kick	3 min x 2	3 min x 2		3 min x 2	3 min x 2
Deep end hip flexion	3 min x 2	3 min x 2		3 min x 2	3 min x 2
Deep end walk	3 min x 2	3 min x 2			3 min x 2
Intervention:	Treatment 16	Treatment 17	Treatment 18	Treatment 19	Treatment 20
Seated hip flexion with TA activation		4 sets 10 reps		4 sets 10 reps	
Standing row with red resistance band		4 sets 10 reps		4 sets 10 reps	
Seated hamstring stretch		2 sets 20 sec hold		2 sets 20 sec hold	
STM to lumbar paraspinal L1-L5		10 min		10 min	
NuStep		4 resistance 10 min		4 resistance 10 min	
Shallow end ambulation	3 min x 2		3 min x 2		3 min x 2
Shallow end side step	3 min x 2		3 min x 2		3 min x 3
Shallow end hip flexion	3 min x 2		3 min x 2		3 min x 2
Deep end hang	3 min x 4		3 min x 3		3 min x 3
Deep end scissor kick	3 min x 2		3 min x 2		3 min x 2

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Deep end hip flexion	3 min x 2		3 min x 2		3 min x 2
Deep end walk	3 min x 2		3 min x 3		3 min x 2

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386 Key: STM = soft tissue manipulation, TA = transverse abdominus, min = minute, sec = seconds

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406 **APPENDICES**

407 **Appendix 1. Home Exercise Program**


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HIP / KNEE - 21
Strengthening: Hip Abduction (Side-Lying)

Tighten muscles on front of RIGHT / LEFT thigh, then lift leg ___ inches from surface, keeping knee locked.

Repeat 15 times per set. Do 1 sets per session.

Do 1 sessions per day.



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HIP / KNEE - 77
Functional Quadriceps
Sit to Stand

Sit on edge of chair, feet flat on floor. Stand upright, extending knees fully.

Repeat 10 times per set.

Do 1 sets per session.

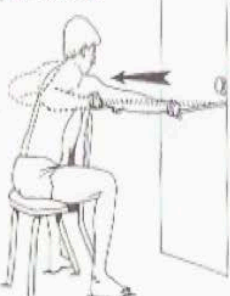
Do 2 sessions per day.



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BACK - 43 Bilateral Scapular Retraction

Wrap tubing around both fists. Pull arms back while bringing shoulder blades together as if rowing a boat.



Repeat 15 Repetitions/set.

Do 1 Sets/session.

Do 1 Sessions/day.

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