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Core Strengthening and Lower Extremity Flexibility; A Model for Physical Therapy Treatment of Acute Nonspecific Low Back Pain: Case Report

Todd Wilde, SPT

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

43

44 Abstract

45

46 **Background & Purpose:** Effective physical therapy treatment strategies are needed in
47 order to improve outcomes for patients with low back pain. Current trends indicate that
48 treatment effect size could be enhanced by implementing patient-specific management
49 strategies based on examination findings (1, 2). The purpose of this report is to describe
50 the physical therapy management and functional recovery of an individual with work-
51 related acute nonspecific low back pain based on a treatment approach consisting of
52 core strengthening and lower extremity flexibility.

53 **Case Description:** The patient is a 51 year-old male with a one-month history of low
54 back pain without radiculopathy secondary to a work-related lifting injury. His symptoms
55 compromise his ability to optimally perform his regular work activities which include
56 prolonged standing, walking, bending, and lifting. The patient completed a three-week,
57 six-visit episode of care consisting of education, core stabilization exercises,
58 cardiorespiratory endurance exercises, lower extremity strength exercises, spine
59 flexibility exercises, lower extremity flexibility exercises, spinal mobilization techniques
60 and soft tissue mobilization techniques.

61 **Outcomes:** Outcome measures (Oswestry Low Back Pain Disability Questionnaire
62 (OLBPDQ) and Focus On Therapeutic Outcomes (FOTO)) were taken on the first and
63 last visits. Over the course of the treatment plan, the patient reported and demonstrated
64 mild symptomatic and functional improvements which were supported by FOTO results

65 (Intake: 46, Discharge: 63). OLBDQ results improved but did not surpass the minimum
66 detectable change (Intake: 30, Discharge: 26).

67 **Discussion:** Over the course of three weeks, management strategies resulted in
68 modest positive outcomes represented by improvements in OLBDQ scores, FOTO,
69 and pain scale. However, further research is needed to report upon the outcomes of this
70 approach in managing individuals presenting with acute non-specific low back pain.

71 Word Count: 275

72

73 **Background and Purpose**

74

75 In a 2010 article, The Epidemiology of Low Back Pain⁽³⁾, the one year incidence of a
76 first-ever episode of low back pain ranges between 6.3% and 15.4%, while estimates of
77 the one year incidence of any episode of low back pain range between 1.5% and 36%.

78 Due to the notable prevalence of low back pain and its impact on patient activity and
79 participation, there is value in enhancing the effectiveness of management strategies.

80 Although there are various schools of thought and treatment strategies for low back
81 pain, there is limited research investigating the efficacy of treatment strategies based on
82 core stabilization exercises combined with lower extremity flexibility exercises. The
83 purpose of this report is to describe the management and functional recovery of an
84 individual with low back pain throughout an episode of physical therapy care based
85 primarily on principles of core strengthening and lower extremity flexibility.

86

87 **Case Description & History**

88

89 MK is a male in his 50's who lives at home with his family. MK was referred to physical
90 therapy secondary to a low back injury sustained while bending and lifting a TV at work
91 one month prior to his first physical therapy visit. After lifting the TV, he reported feeling
92 an immediate "twinge" of pain but continued working his normal shift hours. The next
93 morning, he woke up with increased stiffness and pain aggravated by his normal
94 activities and scheduled a visit with his doctor. Currently, MK is unable to optimally
95 participate in his normal roles at work, at home, and in recreational and community
96 pursuits due to activity limitations including difficulty handling heavy objects (lifting,
97 pushing, pulling, etc.), prolonged standing, prolonged walking and prolonged sitting due
98 to impairments including pain, flexibility, range of motion, strength, and posture. Except
99 for his current episode of low back pain, his previous medical/surgical history is
100 unremarkable. He takes over-the-counter NSAIDS (Ibuprofen) for pain. He has briefly
101 tried acupuncture and chiropractic treatment for his current condition with limited and
102 temporary results. He has no family history of his condition and has not received any
103 MRI or X-Ray diagnostic imaging. Through physical therapy treatment, he hopes to
104 return to his premorbid level of pain-free functionality. MK gave written consent for the
105 conduction of this case report.

106

107 **Systems Review**

108

109 Upon admission, a systems review was conducted (See table 1.) Musculoskeletal and
110 cardiopulmonary impairments were noted. Other systems were unremarkable.

111

112 **Clinical Impression 1**

113

114 MK is unable to optimally participate in his normal roles at work, at home, and in
115 recreational and community pursuits due to activity limitations including difficulty with
116 handling heavy objects (lifting, pushing, pulling, etc.), prolonged standing, prolonged
117 walking and prolonged sitting due to impairments including pain, flexibility, range of
118 motion, strength, and posture. Upon initial review of the case description, it is
119 hypothesized that the case involves pathology such as lumbar disc and/or facet
120 dysfunction, SI joint dysfunction, and hip joint pathology. MK is a good candidate for this
121 case report due to the fact that he presents with a highly prevalent condition and he has
122 no previous history of low back pain. Further examination will include the following tests
123 and measures in order to examine the musculoskeletal factors potentially contributing to
124 the patient's symptoms.

- 125 ● Postural Assessment
- 126 ● Dermatomal/Myotomal strength and sensation assessment
- 127 ● Straight Leg Raise Test
- 128 ● Slump Test
- 129 ● Lumbar Quadrant Test
- 130 ● Thomas Test
- 131 ● Ely's Test
- 132 ● Spinal ROM
- 133 ● Oswestry Low Back Pain Questionnaire
- 134 ● Pain Assessment
- 135 ● FOTO

136

137 **Examination - Tests and Measures**

138

139 An initial examination including the tests and measures described previously in “Clinical
140 Impression 1” were performed and recorded (See table 2). Examination of the patient’s
141 chief complaints, mechanism of injury, impairments, activity limitations, and specific
142 tests and measures suggest that the patient’s current condition results from movement
143 dysfunction of the spine and lower extremities, impaired posture, and core weakness.
144 These factors may have contributed to increased risk of injury potentially related to the
145 lifting accident he experienced in his workplace.

146

147 (See table 2 for results of tests and measures taken at admission and discharge and
148 table 3 for reliability and validity data.)

149

150 **Clinical Impression 2**

151

152 The information gathered in the physical therapy examination confirm the initial
153 impression that the patient’s impairments and the activity limitations and participation
154 restrictions stemming from them are most likely related to the lumbar spine rather than
155 hip or sacroiliac pathologies mentioned as differential diagnoses.

156 The primary factors leading to this hypothesis include:

- 157 • Postural Abnormalities: The patient demonstrates forward head and rounded
158 shoulders with increased lumbar lordosis and forward lean, potentially putting

159 unnecessary stress on the lumbar spine and surrounding musculature, especially during
160 lifting activities.^(4,5)

161 • Tight lower extremities: Special testing and movement assessment of the lumbar
162 spine and lower extremities revealed significant musculoskeletal tightness in the hips
163 and low back. Significant tightness was noted in the hip flexors, hamstrings, gluteals,
164 quadratus lumborum, and lumbosacral paravertebral musculature. Each of these tight
165 muscles/muscle groups contribute to suboptimal biomechanics which put the patient at
166 risk for musculoskeletal injury, especially during lifting activities.^(6,7)

167 • Impaired core strength: Examination of thoracolumbar muscle strength revealed
168 weakness in core stabilizers. In addition to manual muscle testing (¼ in all
169 thoracolumbar planes), the patient had moderate difficulty maintaining the position for
170 an abdominal crunch against gravity. Weak core stabilizers suggest that the patient may
171 have been at increased risk for injuries to the lumbar spine while lifting.^(8,9)

172 • Palpation and description of symptoms: Palpation revealed muscle tightness and
173 general spinal stiffness with all motions. Pain and tenderness was noted to be most
174 intense in the patient's right paraspinal musculature spreading into the quadratus
175 lumborum, gluteus medius, gluteus minimis, and piriformis. The patient described his
176 symptoms as gradually increasing achy to sharp pain that intensifies depending on the
177 duration and difficulty of his work activity. The combination of his affected areas and the
178 description symptoms suggests a muscle strain of the lumbar musculature caused
179 and/or aggravated by previously mentioned risk factors combined with lifting.

180

181 The examination did not reveal any “red flag” concerns that would require referral to
182 other professionals for further consultation or any other comorbidities or personal
183 factors that could potentially distort the data throughout the progression of the case
184 report. Thus the patient continues to be appropriate for the case report and will initiate a
185 physical therapy intervention plan of care which will include core stabilization exercises,
186 lower extremity stretches, spine flexibility exercises, cardiovascular exercises, postural
187 exercises, manual mobilizations to the spine, and soft tissue mobilization to the lumbar
188 region. Baseline outcome measures including the Oswestry Low Back Disability Index
189 and the FOTO will be taken on the first visit and taken again on the sixth visit. The
190 patient will then be re-evaluated and consult with his primary care physician about the
191 possibility of extending physical therapy treatment.

192

193 **Physical Therapy Diagnosis and Practice Pattern**

194 Formal examination and evaluation procedures determined the following:

- 195 ● ICD-9 724.2 - Lumbago
- 196 ● Practice Pattern 4f: Impaired Joint Mobility, Motor Function, Muscle Performance,
197 Range of Motion, and Reflex Integrity Associated With Spinal Disorders.

198

199 **Prognosis**

200

201 The current clinical practice guidelines⁽²⁾ for treatment of low back pain indicate that
202 there is strong evidence to support the use of trunk coordination, strength, and
203 endurance exercises to reduce pain and disability in patients with low back pain.
204 Furthermore, personal factors such as the patient’s positive attitude with respect to

205 exercise and willingness to participate in physical therapy interventions despite mild
206 discomfort positively contribute to his favorable prognosis.

207

208 **Plan for Intervention**

209

210 In order to select interventions for the plan of care, first it was crucial to understand the
211 relationships between the patient's participation restrictions, activity limitations, and
212 impairments. After establishing those relationships, it was then possible to use
213 examination findings to develop interventions that would that aim to increase functional
214 ability and decrease pain. Many of the musculoskeletal findings in this patient's
215 presentation including tight hamstrings, tight hip flexors, increased lumbar lordosis, and
216 weak abdominals correspond with the description of "lower crossed syndrome" (LCS)
217 described by Janda, V.⁽¹¹⁾. In his work, he describes how muscle imbalances noted in
218 LCS potentially lead to joint dysfunction. Thus the interventions in the patient's plan of
219 care were designed to address specific musculoskeletal impairments noted during the
220 examination. Table 4 identifies the significant findings in the evaluation that lead to the
221 selection of interventions. (See table 4.)

222

223 **Short-Term and Long-Term Goals**

224

225 After examination and evaluation, functional goals were established. (See table 5.)

226

227 **Interventions**

228

229 **Coordination, communication, and documentation**

230

231 The patient's treatment sessions were documented using an electronic medical record
232 system. After the sixth physical therapy session, the patient was referred back to his
233 primary care physician to discuss the possibility of further treatment.

234

235 **Patient related instruction**

236

237 During the patient's initial visit and initial examination, the patient was educated about
238 how each of the findings from the examination contribute to his condition and how
239 improvements in these measures could improve functional outcomes. Throughout the
240 episode of care, the patient was instructed on proper performance of therapeutic
241 exercise, body mechanics, lifting techniques, and home exercise.

242

243 **Procedural Interventions**

244

245 The typical flow of each visit followed the following format:

- 246 1. Modalities and/or bike warm-up: Heat to thoracolumbar spine with the patient
247 supine with legs propped.
- 248 2. Therapeutic exercises and stretches
- 249 3. Low-grade manual treatments

250 Each of the procedural interventions provided were selected based on treatment
251 strategies described in current literature. The following list includes the interventions
252 performed along with references to their rationale for use in current literature.

- 253 ● Heat pack
- 254 ● Bike warm-up (recumbent style)
- 255 ● Quadriceps stretch (Usually performed standing) (7)
- 256 ● Hamstring stretch. (Performed supine with a loop strap) (7)
- 257 ● Single knee to chest stretch. (Performed supine) (7)
- 258 ● Piriformis stretch. (Performed supine) (7)
- 259 ● Quadratus lumborum stretch. (Performed standing)
- 260 ● Forward Planks for anterior core strength and stability. (10)
- 261 ● Bridges for core stability and hip extensor strength and stability. (10)
- 262 ● Bird Dogs (patient in a quadruped position alternates lifting opposite UE/LE while
263 practicing core stabilization) for core stability. The patient was instructed to
264 perform the exercise while maintaining the spine in a neutral position and
265 avoiding any spinal rotation or lateral shifting. This exercise is designed to
266 encourage and/or develop core stability during functional activities such as
267 reaching and lifting. (12)
- 268 ● Side-step against resistance (patient side steps against resisted proved by a
269 cable system held in the patient's hands at midline one forearm length away from
270 the body. This exercise is designed to encourage and/or develop hip abductor
271 strength and core stability against rotational forces. (13)
- 272 ● Lunges. This exercise is designed to develop hip extensor strength, hip flexor
273 flexibility, and coordinate spinal stabilizer muscles with functional movement. It
274 also aims to promote safe lifting mechanics by encouraging movement in the
275 lower extremities rather than the spine. (4)
- 276 ● Spine joint mobilizations to lumbar segments grades II-IV rotational and A/P
277 glides. (2)
- 278 ● Soft tissue mobilization to thoracolumbar paravertebral musculature to decrease
279 pain, muscle tightness, and myofascial restrictions.

280

281

282 The following table provides detailed timeline of the intervention timeline.

283 Table 6

	Rx Day 1	Rx Day 2	Rx Day 3	Rx Day 4	Rx Day 5	Rx Day 6
Bike Warm-Up		10 min.	10 min.	10 min.	10 min.	10 min.
Quadriceps Str.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.
Hamstring Str.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.
Single Knee to Chest Str.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.
Piriformis Str.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.
Quadratus Lumborum Str.		3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.	3 x 30 s.
Forward Planks (Appx. 3)			3 x 10 s.	5 x 10 s.	10 x 10 s.	10 x 10 s.
Bridges			2 x 10	2 x 15	2 x 15	2 x 15
Bird Dogs (Appx. 4)				2 x 15	2 x 15	2 x 15
Side Step against resistance					2 x 15	2 x 15
Lunges (Appx. 5)					4 x 10	4 x 10
Review HEP		X	X	X	X	X
Spine joint mobs: Grade II-IV glides to lumbar segments.		10 min.	10 min.	10 min.	10 min.	10 min.
Soft tissue mobilization: Thoracolumbar PVM and right hip abductors	10 min.	5 min.	5 min.	5 min.	5 min.	5 min.
Heat pack		10 min.	10 min.	10 min.	10 min.	10 min.

284

285 **Outcomes**

286 Over the course of the treatment episode, the patient reported decreased pain (Pain
287 score improved from 6-7/10 to 4-5/10) and improved capacity to perform work activities
288 for longer duration without experiencing severe symptoms (Duration performing work
289 activities before aggravating symptoms improved from 1-2 hours to 3-5 hours). He also
290 demonstrated improved lower extremity flexibility measured using the fingertips-to-floor
291 method (Distance improved from 31cm to 14cm) and improved posture (Slight
292 improvements in pelvic tilt, lumbar lordosis, and shoulder alignment by visual
293 inspection). Outcome measures were taken on the first and last visits. Both measures
294 indicated improvement consistent with all other tests and measures. The patient
295 reported and demonstrated mild symptomatic and functional improvements which were

296 supported by FOTO results (Intake: 46, Discharge: 63). OLBPDQ results also improved
 297 from admission to discharge (Intake: 30, Discharge: 26).

298
 299 The following figures show the results of tests and measures taken upon admission and
 300 discharge.

301
 302 Table 2

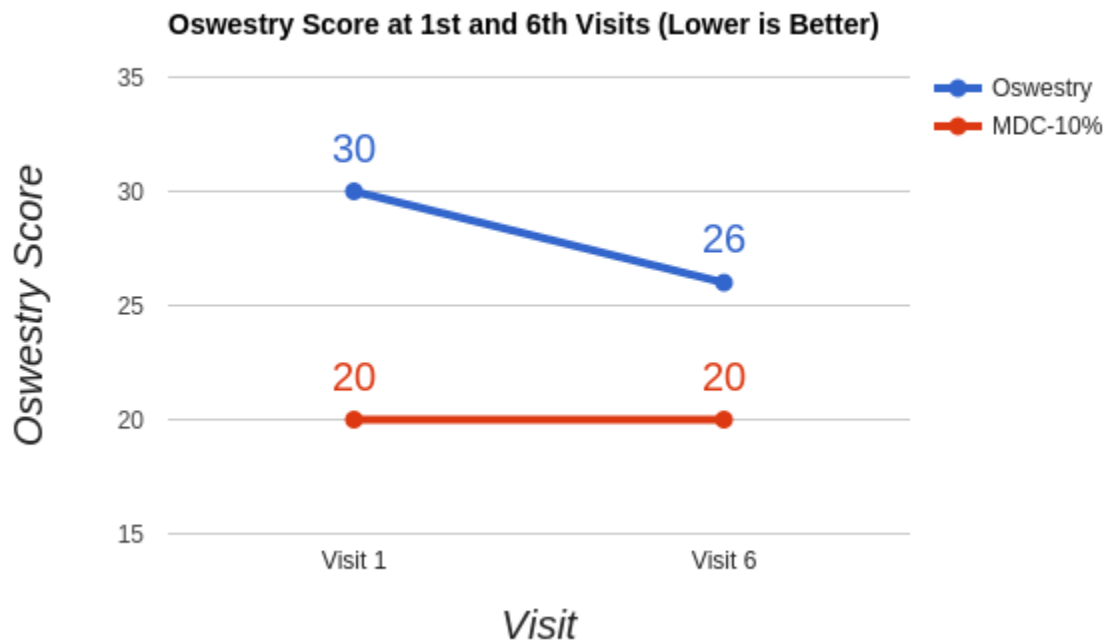
Tests and Measures	Admission	Discharge
Straight Leg Raise Test	Testing provoked symptoms, revealed tight hamstrings, but did not cause radiating pain.	Not Tested
Lumbar Quadrant Test	Negative: Unable to provoke symptoms with quadrant test positioning	Not Tested
Thomas Test	Testing revealed tight hip flexors	Slight improvement
Ely's Test	Testing revealed tight hip flexors	Slight improvement
Faber's Test	Testing revealed tight anterior hip capsule/musculature but did not indicate hip or SI dysfunction.	Not Tested
Range of Motion	Lumbar Flexion (tape): 31 cm to floor Lumbar Extension (goniometer): 10 degrees	Lumbar Flexion (tape): 14 cm to floor Lumbar Extension (goniometer): 25 degrees
MMT	Gross thoracolumbar assessment: 4/5 All other LE motions: 5/5	Gross thoracolumbar assessment: 5/5 All other LE motions: 5/5
Posture	Forward head and rounded shoulders with increased lumbar lordosis and forward lean	Slight improvement in pelvic tilt (decreased lumbar lordosis), head position, and shoulder position.
Oswestry Low Back Pain Questionnaire	30% disability	26% Disability
FOTO	46	63
Pain	6-7/10	4-5/10

303
 304 Figure 1: FOTO score upon admission and discharge.



305

306 Figure 2: Oswestry score taken upon admission and discharge.



307

308

309 **Discussion**

310

311 Over the course of physical therapy management MK demonstrated improvements in all
312 functional outcome measures. The FOTO score improved from 46 to 63, surpassing the
313 clinically important difference and the minimum detectable change of 5 and 6,
314 respectively (See “Outcomes”). The OLBDQ improved from 30 to 26 which was not
315 sufficient to surpass the minimum detectable change of 20 (See “Outcomes”). Despite
316 these shortcomings, it is important to note that these improvements were made over the
317 course of six visits (three weeks) and to consider the potential for improvement, taking
318 into account the trend in progress from admission to discharge.

319 The improvements in the patient’s pain level, work capacity, and functional
320 outcome measures may be attributable to improvements in core strength, lower
321 extremity flexibility, and posture. As described previously, current evidence-based
322 practice guidelines and strategies suggest that improvements in these factors may
323 contribute to positive outcomes such as improved functional movement, decreased
324 pain, and functional ability. MK was able to achieve similar outcomes over the course of
325 his episode of care.

326 Further research with larger sample sizes and extended duration is needed to
327 investigate the outcomes using this model of physical therapy management for acute
328 nonspecific low back pain.

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409 **Tables**

410
411
412 Table 1

Cardiovascular/Pulmonary	Impaired cardiorespiratory function due to deconditioning secondary to the inability to participate in endurance activities without pain.
Musculoskeletal	Impaired strength, flexibility, range of motion, joint mobility, posture, and symmetry.
Neuromuscular	No impairments noted
Integumentary	No impairments noted
Communication	No impairments noted

Affect, Cognition, Language, Learning Style	No impairments noted. Primary language: English.
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413

414 Table 3

Test	Sensitivity	Specificity
Straight Leg Raise Test ⁽¹⁴⁾	0.52	0.89
Lumbar Quadrant / Kemp Test ⁽¹⁵⁾	N/A	N/A
FABER Test ⁽¹⁶⁾	0.82	0.46
Thomas Test ⁽¹⁷⁾	N/A	N/A
Ely's Test ⁽¹⁸⁾	0.56-0.59	0.64-0.85
Oswestry Disability Index ⁽¹⁹⁾	NA	
Focus On Therapeutic Outcomes ⁽²⁰⁾	NA	

415

416 Table 4

Participation Restrictions	
<ul style="list-style-type: none"> • Patient is unable to participate in work activities due to pain and/or inability to perform work-specific tasks 	
Activity Limitations	
<ul style="list-style-type: none"> • Forward bending to lift more than 30 lbs. • Standing and/or walking for more than 1 hour. 	
Impairments	Interventions
<ul style="list-style-type: none"> • Impaired strength in thoracolumbar motions • Impaired lower extremity flexibility • Impaired spine and hip joint mobility • Impaired posture • Pain 	<ul style="list-style-type: none"> • Core strength and/or stabilization exercises • Lower extremity stretches • Joint and soft tissue manual mobilization • Exercises for postural re-education • Modalities for pain relief

417

418 Table 5

Plan of Care Goals	
Short-term goal 1	Patient will report pain no greater than 3/10 (Pain severity at worst at initial evaluation: 7/10) during work activities with restrictions (30 lb. lifting restriction and permission to sit periodically as needed) by [3 weeks from 1st visit]
Short-term goal 2	Patient will report 85% compliance (exercises performed at least one time per day 6/7 days per week) with prescribed home exercise program by [3 weeks from 1st visit]
Long-term goal 1	Patient will report pain no greater than 1/10 (Pain severity at worst at initial evaluation: 7/10) during work activities by [6 weeks from 1st visit]
Long-term goal 2	Patient will demonstrate 5/5 muscle strength in all thoracolumbar planes (Thoracolumbar MMT at initial evaluation: 4/5) by [6 weeks from 1st visit]

Long-term goal 3	Patient will return to full work duty without restrictions and without symptoms by [6 weeks from 1st visit]
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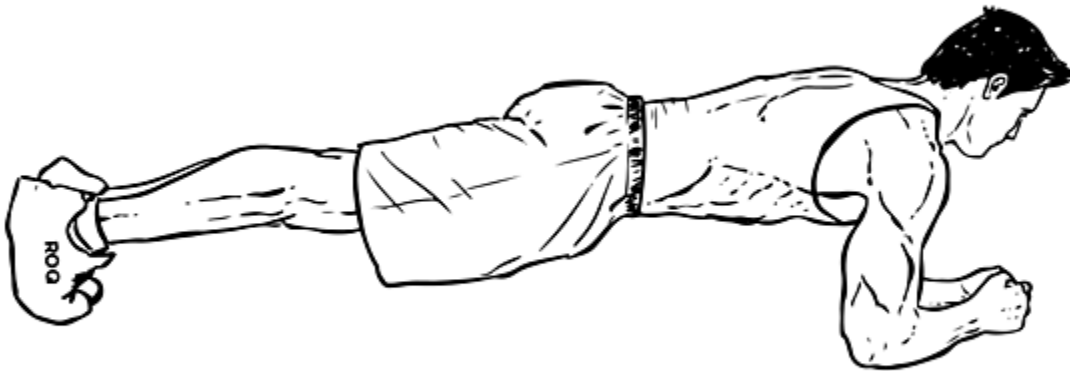
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422 **Appendices**

423 Appendix 1 (21)

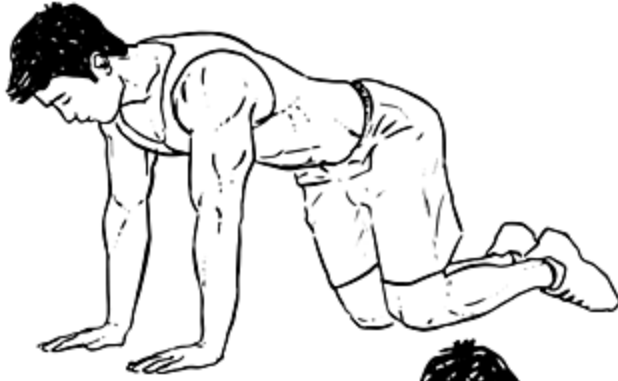


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426 Appendix 2(21)



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