

Stuart McGill's Low Back Disorders (2016)

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Learning Objectives

After reading Low Back Disorders, the participant will be able to:

1. List several common sense recommendations for treating low back problems.
2. Explain why patients with back problems often continue to have pain even after treatment.
3. Identify what should be included in exercises for protecting the low back to make them more effective.
4. Explain why tissue damage that causes back pain often goes undiagnosed.
5. Identify the work related risk factors in the development of low back disorders.
6. Identify the muscles of the abdominal wall.
7. Identify the muscles involved in spinal stability.
8. Explain what happens to spinal motion during the process of disc degeneration.
9. Explain why sit-ups are not a recommended exercise for the abdominal muscles.
10. Explain why full lumbar flexion should be avoided immediately after arising in the morning.
11. Identify two factors to consider to minimize stress on the back when lifting.
12. Explain why lifting should be avoided after prolonged periods of stooping or sitting.
13. List strategies to use to reduce back problems caused by prolonged sitting.
14. Explain what is meant by the term Cross Pelvis Syndrome.

15. Explain the positive slope of improvement and its use in evaluating patient progress.
16. Identify several techniques used to teach an individual how to find and use neutral spine when performing active tasks.
17. Explain how to correctly brace the abdominals.
18. Explain the purpose of provocative testing.
19. Explain why traditional exercises for the back may not be effective.
20. Explain the “flossing” technique and when it is used.
21. Explain why the prone back extension exercise is not recommended for anyone at risk for low back injury.
22. Explain the correct form to use to perform a curl-up exercise and how to progress it from a basic to an advanced exercise.
23. Explain how to modify the side bridge for an individual unable to tolerate shoulder load.
24. Explain how to perform a “bird dog” exercise for an individual with a very de-conditioned back.
25. Explain why exercise training for back rehabilitation should begin on a stable rather than a labile surface.



CEC/CEU Test for Low Back Disorders

Choose the best answer. Mark all answers on the answer sheet

1. Common sense recommendations for alleviating or preventing back problems may be inappropriate because:
 - a. These recommendations are only promoted by people with no formal medical training
 - b. These recommendations are backed by little or no scientific evidence that proves they are beneficial
 - c. These recommendations are not documented and have to be learned through experience
 - d. These recommendations are not supported by clinicians or physicians

2. A factor used by lawyers and Compensation Boards to measure back disability and award compensation is:
 - a. The location on the spine where injury occurred
 - b. The ability of the lumbar spine to tolerate compressive loads
 - c. The loss of range of motion in the spine
 - d. The amount of rehabilitation required in order to return to work

3. Which of the following statements is true?
 - a. Age has no affect on the spine's ability to bear a compressive load
 - b. Females are able to bear higher loads than males
 - c. Older females are able to bear higher loads than younger females
 - d. Younger males are able to bear higher loads than older males

4. What is the main problem with using static MRIs to assess back issues?
 - a. The position that the patient needs to be in becomes very uncomfortable thus making the images unclear
 - b. They are too expensive to use for basic back problems
 - c. It cannot diagnose psychological pain which is the majority of back problems in patients
 - d. Because the patient is in an unloaded position, it does not show movement pathologies that can also show pain

5. The percentage of idiopathic back problems can be solved by:
 - a. Healthcare professionals becoming more familiar with the mechanics of the spine
 - b. Better diagnostic equipment
 - c. A psychological evaluation
 - d. Anti-depressant recommendations

6. Identifying all of the following will help provide a precise diagnosis EXCEPT:
 - a. Loads that cause pain
 - b. Motions that cause pain
 - c. Stretches that cause pain
 - d. Postures that cause pain

7. When diagnosing by hypothesis, what is the correct order of author's approach?
 - a. History, observation, initial impression, testing, planning
 - b. Initial impression, history, observation, testing, planning
 - c. Observation, initial impression, history, planning, testing
 - d. Observation, testing, history, initial impression, planning

8. Which of the following statements about work related back problems is true?
 - a. Some scientists and physicians believe psychosocial factors play a more important role in low back problems than mechanical factors
 - b. The modern work place is a more physically active work environment which is more damaging to the back
 - c. Research has developed surgical procedures that can cure any work related back problem
 - d. Due to medical advances in surgical and non-surgical therapies for low back problems back pain and work disability has decreased in recent years

9. Patients with chronic bad backs often continue to have problems even after receiving treatment because:
 - a. The cause of most chronic back pain cannot be determined so back rehabilitation is rarely permanent
 - b. Patients continue to do the same type of physical activities they always have because mechanical concerns were not addressed in their treatment plan
 - c. Patients don't follow the exercise and stretching guidelines their doctors or therapists prescribe for them
 - d. If a medical treatment or recommended therapy is not productive, patients frequently change doctors seeking pain relief

10. Ortiz and Bordia found a relationship between:
 - a. Pain and mechanical loading at work
 - b. Pain threshold and former athletes with back injuries
 - c. Vectors and the amount of damage to a disc
 - d. Loading, damage, and osteoporosis

11. In the study conducted by Carey and colleagues in 2009, what percentage of adults with low back pain had used narcotics the previous month?
 - a. 30%
 - b. 40%
 - c. 50%
 - d. 60%
12. In order for exercises for the back to be the most effective in helping protect the back, they should:
 - a. Emphasize increasing the strength in both the upper and lower back
 - b. Emphasize improving the flexibility of the back muscles
 - c. Emphasize the ability of the back to safely lift heavy loads
 - d. Emphasize muscle endurance, not just muscle strength
13. Which of the following is not a common recommendation for improving the health of the back?
 - a. Strengthening the abdominal muscles with sit ups will make the back healthier
 - b. When performing sit ups, bend the knees
 - c. When lifting, bend the back and keep the knees straight
 - d. To protect the back, strengthen the muscles that stabilize the spine
14. What did Ashmen, Swanik, and Lephart find that was more commonly associated with back pain in their subjects?
 - a. Tight hip flexors
 - b. Asymmetry between sides
 - c. Tight hamstrings
 - d. Weak hamstrings
15. What specific tissue can take years to recover from relatively minor injuries?
 - a. Ligaments
 - b. Tendons
 - c. Aponeurosis
 - d. Discs
16. Which of the following statements about back injuries is true?
 - a. Any injury to the tissues of the lower back should heal in 12 weeks
 - b. Treatment methods have become so effective that no back injury should last longer than 4 months
 - c. Back injuries that cause disc bulging may cause osteophytes to develop years after the injury
 - d. Tissue damage to the lower back always results in a life time of back pain and disability

17. Which of the following statements about increasing the range of motion in the spine as part of back rehabilitation is true?
- Increasing the range of motion in the spine is an accurate and measurable factor for determining the success of back therapy
 - Increasing the range of motion in the spine has been shown by some research to increase the risk of future back problems
 - Increasing the range of motion in the spine always enhances athletic performance
 - Increasing the range of motion in the spine improves joint stability and prevents injury in all joints
18. The author suggests that many low back surgeries are unsuccessful because:
- ROM was not addressed
 - Surgeries were done too late in order to avoid further damage
 - Surgeries were done too soon and the patient had not exhausted other conservative options
 - Surgeons do not know what they should about the back
19. Which of the following is considered to be a good reason to consider back surgery?
- Radiating pain from sciatica
 - Muscle atrophy
 - Peripheral numbness
 - Loss of bowel or bladder control
20. One of the primary causes of low back injuries is:
- Twisting the back while attempting to lift an object
 - A single impact on the spine occurring during participation in a sports activity
 - Injuries to the back resulting from a car or other vehicle accident
 - Cumulative trauma caused by repetitive overload to the point of tissue failure
21. Stretched ligaments can lead to all of the following EXCEPT:
- Shearing forces on the rotatores
 - Injury of unisegmental structures
 - Local instability'
 - Increased shearing and bending loads on the neural arch
22. The objective of injury prevention strategies is to:
- Expose the tissue to loads to increase adaptation
 - Rest the area to allow it to heal
 - Avoid the U-shaped relationship of rehab
 - Focus on a single variable such as one-time load magnitude

23. Which statement is FALSE concerning randomized controlled trials?
- It provides the best and most accurate analysis for low back pain
 - It is regarded as the gold standard in medicine
 - It has led to questionable yet popular opinions regarding back pain
 - They are not suitable for unclassified low back pain
24. The Bigos and colleagues study found that:
- Personal risk factors were important for determining severity of low back problems
 - Psychosocial factors failed to account for 85% of the causes of low back disorders
 - The most powerful variable for predicting those jobs with low back disorders was maximal low back moment
 - An odds ratio greater than 4 suggests an increased risk from a specific factor
25. Which of the following statements is true regarding the epidemiological studies included for review?
- The Norman and colleagues study is often quoted to support the viewpoint that psychosocial factors are the most important causes of back disorders
 - The studies suggest that both psychosocial factors and physical loading factors are important variables for low back disorders
 - The Bigos and colleagues study surveyed industrial lifting jobs and, using medical records, classified each type of job as being either low, medium, or high risk for causing low back disorders
 - The studies all concluded that in the industrial jobs studied, psychosocial factors and not mechanical loading was the most important cause of low back disorders
26. Workers who suffer a job related low back tissue injury may not be able to return to work because:
- Their rehab program uses a work hardening approach that incorporates the injury mechanism as part of treatment and causes more tissue damage
 - The worker acts disabled in order to receive more compensation
 - The employer may conclude the worker is unable to meet the physical challenges of their job
 - The worker may have nonspecific back pain which can't be diagnosed or successfully treated within 6 – 12 weeks

27. Tissue damage that causes low back pain often goes undiagnosed because:
- Low back pain that does not improve within six weeks is not considered disabling, so further diagnosis is not necessary
 - If a causative event, such as an accident or injury, can't be identified it is assumed there is no organic basis for pain
 - Current tests used to diagnosis low back pain often don't detect articular damage, fractures, or deep fissures of the annulus
 - If no lesion is detected using typical diagnostic procedures the low back pain is assumed to be idiopathic with no organic basis
28. All of the following statements concerning nonspecific or undiagnosed low back disorders are true except:
- To aid in making functional diagnosis of low back pain, physicians can utilize provocative testing
 - There is no link between biomechanical factors and psychosocial factors in association with low back disorders
 - According to some research, chronic low back problems can benefit from treatment that includes physical therapy and exercise
 - Chronic pain can produce psychological difficulties which disappear when the pain is relieved
29. Epidemiological studies have identified all of the following work-related tasks as risk factors in the development of low back disorders except:
- Jobs that require maintaining deviated postures such as trunk flexion
 - Jobs that require frequent bending and twisting
 - Jobs that require multiple activities involving both sitting and moving
 - Jobs that involve vibration, particularly seated vibration
30. Studies comparing work load and subsequent development of back pain have shown:
- Workers who performed heavy work in their early years had disc degeneration in their later years
 - Workers who performed no heavy physical work in their early years had arthritic changes in their back in later years
 - Workers who performed heavy work in their early years were more prone to develop nerve entrapment syndrome in later years
 - Workers who performed no heavy physical work in their early years were more prone to develop nerve entrapment syndrome in later years
31. Back injury that occurs when an individual performs an ordinary benign task can be the result of that individual's _____, with the task often not recorded as the cause of the injury
- Tight, inflexible back muscles
 - Deficient motor control mechanisms
 - Weak back muscles
 - Increased range of motion in the spine

32. Evidence supports all of the following statements regarding back injury as true except:
- Injury to low back tissue can last for up to ten years
 - Psychosocial issues and biomechanical issues influence each other in terms of both absenteeism and recovery
 - Disc herniation is not always caused by excessive loads, but can also be caused by repetitive motion with light loads
 - All of the above statements are true
33. Muscle activation and motion can be generated from _____ or from _____.
- Subconscious learned muscle memory residing in the brain; a conscious thought in the brain
 - An encoded pattern residing in the spinal cord; a conscious thought in the brain
 - An encoded pattern residing in the spinal cord; a reflexive action originating in the brain
 - Only conscious thought in the brain produces muscle activation and motion
34. In the vertebrae, nutrients such as oxygen and glucose are transported in the _____.
- Cancellous bone
 - End plate
 - Cortical bone
 - Lamina
35. All of the following statements regarding the architecture of the vertebrae are true except:
- According to many textbooks, the major shock absorbers of the spine are the discs
 - Under a compressive load the end plates of the vertebrae bulge inward
 - When the transverse trabeculae fracture under a compressive load the cancellous bone is unable to rebound back to its original shape
 - The alignment of the trabeculae is with the dominant trajectories of stress
36. Older women with osteoporosis will have which of the following changes in their vertebrae?
- A loss of cancellous bone that forms vertical columns that run from end plate to end plate
 - An increase in mineral content and bone density
 - Heavy bony gusseting at the intersection of the vertical columns and transverse trabeculae
 - A loss of mechanical integrity of the transverse trabeculae

37. An injury which can cause extensive trabeculae damage but can go unnoticed in a diagnostic exam is:
- A herniated disc
 - A Schmorl's node
 - Stellate pattern fractures
 - A slow crush fracture
38. An injury often misdiagnosed as a herniated disc is:
- A degenerated disc
 - A thoracic stress fracture
 - An end plate fracture
 - A spinous process fracture
39. Once Modic changes have occurred, how long can pain typically last?
- 12-18 months
 - 12-18 weeks
 - 6-12 months
 - 18 months or longer
40. The facet joints on the transverse processes are _____ joints and the superior facets together with the transverse process are attachment sites for the _____ muscle groups
- Cartilagenous; longissimus and iliocostalis extensor
 - Synovial; longissimus and iliocostalis extensor
 - Fibrous; longissimus and iliocostalis flexor
 - Facet; longissimus and iliocostalis extensor
41. Repetitive cyclic full spine flexion and extension can eventually cause a fatigue fracture in the pars and can lead to _____ which is an injury often found among _____.
- A degenerated disc; female gymnasts
 - A herniated disc; professional cricket players
 - Spondylolisthesis; professional weight lifters
 - Spondylolisthesis; female gymnasts
42. Which statement is FALSE concerning the SI joint?
- Painful symptoms are often referred from discogenic disorders irritating the sciatic nerve roots
 - Pain is more likely to be caused by unilateral movements
 - Joint pain often occurs above the L5 level
 - The joint has little mobility

43. Which two components of an intervertebral disc work together to support compressive load when the disc is compressed and bent?
- Lamina and cancellous bone
 - Annulus and nucleus
 - Spinous processes and facet joints
 - End plates and nucleus
44. Which statement is TRUE regarding discs?
- Larger discs can handle more stress during bending and twisting
 - Limacon-shaped discs tend to produce focal bulges posterolaterally
 - Ovoid discs are better suited for high compressive loads
 - The annulus is relative strong in the strengthening spines of young men
45. Which of the following is not a valid conclusion about disc bulging or herniation?
- Disc herniation is associated with fully flexing the spine for a repeated or prolonged period of time
 - There is a link between disc herniation and sedentary occupations requiring prolonged periods of sitting
 - Disc herniations tend to occur more frequently in older spines
 - It appears herniation occurs when the disc is bent to the full end range of motion
46. A large impact on the approach to training torso muscles for rehab and performance is that:
- Line of action and region of muscular attachment are most important
 - Torso muscles are for creating motion
 - These muscles act as straight-line cables for the body
 - Function is optimized when power is generated and the hips and transmitted through a stiffened core
47. Which of the following statements regarding how to accurately estimate muscle force and spinal function is false?
- Large numbers of muscle fibers are not seen in a single MRI or CT scan of pennated muscle
 - Transverse scan information should be combined with data documenting fiber architecture from dissection
 - Specimens of muscles obtained in the anatomy lab are the best source to use to estimate muscle size
 - MRI and CT scans of abdominal musculature done from a supine position underestimate abdominal muscle moment arms

48. Which of the following statements is true regarding the difference between the longissimus thoracis pars lumborum and the longissimus thoracis pars thoracis?
- The pars thoracis has more slow twitch fibers than the pars lumborum
 - The pars thoracis have relatively short contractile fibers and short tendons
 - The forces in the thoracis have the smallest possible extensor moment arm
 - The pars thoracis has fewer slow twitch fibers than the pars lumborum
49. Which muscle is responsible for stopping thoracic and high lumbar hinges in painful backs?
- Rotatores
 - Multifidus
 - Latissimus dorsi
 - Erector spinae
-
50. Which abdominal muscle is most active during sit-ups and curl-ups?
- Internal oblique
 - External oblique
 - Rectus abdominus
 - Transverse abdominus
51. Which muscle(s) need(s) multiple exercises in order to be properly trained?
- Internal and external obliques
 - Rectus abdominus
 - Internal oblique
 - Transverse abdominus
52. The _____, _____, and _____ comprise the layers of the abdominal wall and all three are involved in _____.
- Rectus abdominis, internal oblique, external oblique; extension
 - Rectus abdominis, internal oblique, external oblique; torso twisting
 - Transverse abdominis, internal oblique, external oblique; torso twisting
 - Transverse abdominis, internal oblique, external oblique; flexion
53. Which of the following muscles is believed to be involved in spinal stability and the generation of intra-abdominal pressure?
- Rectus abdominis
 - Transverse abdominis
 - Internal oblique
 - External oblique
54. The primary role of the psoas muscle is:
- Spinal stabilization
 - Hip flexion
 - Back extension
 - Hip extension

55. Which of the following is FALSE concerning the quadratus lumborum?
- When under a compressive load, the first mode of buckling is posterior
 - It is effective in stabilizing all loading modes
 - It has a large lateral moment arm
 - It contracts virtually isometrically
56. Which of the following is not a role of the more superficial spinal extensors?
- Generate posterior force
 - Generate large extension moments over the entire lumbar region
 - Affect only one or two lumbar segments
 - Generate lateral force
57. Which ligament is highly elastic and acts as a barrier to material that could buckle and encroach on the spinal cord?
- Anterior longitudinal
 - Posterior longitudinal
 - Interspinous
 - Ligamentum flavum
58. The _____ ligaments are aligned to the compressive axis of the spine at an oblique angle and the _____ ligaments are aligned parallel to the compressive axis of the spine.
- Interspinous; longitudinal
 - Superspinous; longitudinal
 - Interspinous; superspinous
 - Superspinous; interspinous
59. What is the problem with using cadavers to determine the role of ligaments in injuries?
- Discs swell in cadavers thus producing a preload on the ligaments giving the impression that ligaments are more important in resisting flexion.
 - Ligaments tend to deteriorate as the cadaver sits in a lab, thus making it appear that they play no role at all in injuries
 - The embalming fluid used damages the discs further making it appear that the ligament damage causes severe disc damage
 - Since cadavers are immobile and non-weight bearing, it gives a false impression that the ligaments become weakened and slack under pressure.
60. Why has the function of the interspinous ligament been so misinterpreted for many decades?
- Anatomical artists have drawn the ligament upside down
 - Cadavers do not provide a pure view of the ligament under appropriate pressure and load
 - Many artists did not know of its existence until the past 20 years
 - Anatomical artists had placed it on the wrong side of the spine over a 100 years ago, and it wasn't corrected until recently.

61. Those patients with Spondylolisthesis should avoid:
- Neutral positional exercises
 - Flexion stretches
 - Sitting for prolonged periods
 - Walking
62. Torn spinal ligaments are more common in all of the following EXCEPT:
- Slips
 - Falls
 - Prolonged standing
 - Traumatic sports
63. Which of the following muscles does not attach to the lumbodorsal fascia?
- Internal oblique
 - External oblique
 - Latissimus dorsi
 - Transverse abdominus
64. Which two joints of the pelvis create very small movements?
- Sacral-lumbar and pubis symphysis
 - Sacral-lumbar and anterior pubis
 - Sacroiliac joint and acetabulum
 - Sacroiliac joint and anterior pubis
65. What increases the risk of hip dysplasia?
- Small femoral head
 - Small pubic symphysis
 - Weakened gluteal muscles
 - Shallow acetabulum
66. All of the following statements regarding the muscles of the pelvis and hips is true except:
- The gluteus maximus flexes and externally rotates the hip
 - The Piriformis and quadratus femoris assist in the control of internal and external rotation
 - The quadriceps muscles extend the knee
 - The hamstring muscles eccentrically contract and function as a brake in upright activities such as walking and running

67. Hip flexion power exercises are best reserved for:
- Those early in their rehab program
 - Those with minimal ligament involvement in their back injury
 - Those who no longer have pain
 - Those who have bulging discs, but no herniation
68. What motion is greater in the thoracic spine as opposed to the lumbar area?
- Flexion
 - Extension
 - Twisting
 - Lateral bending
69. Which of the following statements best describes what happens to the motion of the spine during the process of disc degeneration?
- The range of motion increases when disc degeneration reaches grade V
 - The range of motion increases through grades I and II and then starts to decrease when disc degeneration reaches grade III
 - The range of motion in the spine is not affected by disc degeneration until grade V
 - The range of motion increases through grades I, II, III, and IV but is replaced by extreme loss of motion in grade V
70. Which level of the spine has the most range of motion for flexion and extension combined?
- L2-3
 - T12-L1
 - T8-9
 - L4-5
71. Most stiffness in lateral bending occurs where in the spine?
- L5-S1
 - L1-5
 - T1-6
 - T7-12
72. The description that the first 60 degrees of torso flexion occurs in the lumbar spine is:
- A myth
 - Proven true with cadavers
 - Proven true by the author's lab
 - Has not been tested

73. Which exercise below engages the rectus abdominus the most?
- Press-heel sit-up
 - Bent-knee curl-up
 - Bent-knee sit-up
 - Straight-leg sit-up
74. What muscle is most engaged when performing the isometric side support exercise?
- Internal oblique
 - Transverse abdominus
 - Rectus abdominus
 - External oblique
75. When a lifter executes a proper lift, all of the following occur EXCEPT:
- Avoidance of full spine flexion by extending at the hip
 - The abdominal muscles are activated
 - The abdominal muscles produce no movement
 - The pars lumborum extensor muscles are activated
76. In order to lower the load and the torque on the lumbar spine while walking the person who is walking should:
- Take smaller, faster steps
 - Swing the arms while walking
 - Walk faster than a stroll
 - Both b and c
77. When wearing 8 inch high heeled shoes, what muscles is primarily activated?
- Rectus abdominus
 - Erector spinae
 - Transverse abdominus
 - Gluteals
78. Which statement is FALSE concerning sitting?
- Lower abdominal wall is generally involved
 - Sitting upright requires more activation of torso flexors
 - The psoas is activated more so when sitting upright
 - Unsupported sitting requires a greater activation of the erector spinae
79. What did Casthanhero, Duarte, and McGill find in their study concerning sitting postures?
- The rib lift strategy only provided a decrease in loading of the spine
 - There is no best way to sit without too much loading on the spine, therefore, standing more is best
 - Even while sitting, the L5-S1 joint is still flexed at 60 degrees
 - Using a combination of rib lifting and pelvic tilt strategies was ideal

80. What characteristic is common among those with back pain while walking?
- They tend to lean forward
 - They tend to avoid swinging their arms
 - They tend to swing the arms primarily from the elbows
 - They tend to walk to slowly
81. What did Kaneda and colleagues find concerning aquatherapy?
- Walking in the pool decreases spinal load
 - Gluteal and erector spinae activity is increased in the water
 - Venous return is decreased during water exercise
 - Walking in the pool creates no load on the spine while deep water running does increase load
82. What is the definition of antalgic posture?
- A posture affected by ligament damage
 - Forward torso angle
 - Posteriorly tilted pelvis
 - An anterior pelvic tilt due to disc damage
83. Which statement is FALSE concerning backpacks?
- Backpacks should never be used by those with back problems
 - Wearing backpacks helps generate torso extensor moment
 - Wearing backpacks can help alleviate the spine extensors
 - The ability to move the arms more by wearing a light backpack helps decrease compressive loading on the spine
84. Which of the following statements best explains why performing traditional sit-ups is not a recommended exercise for the abdominal muscles?
- Only bent knee sit-ups can be safely performed because bending the knees reduces the load on the spine
 - A compression load of approximately 3300N is imposed on the spine each time a sit-up is performed
 - The compression load imposed on the low back during a sit-up is much higher than the action limit for low back compression set by the National Institute of Occupational Safety and Health
 - All of the above
85. Which statement is FALSE concerning hanging with the arms overhead and flexing the hips?
- It is safer to work the same muscles with a side bridge exercise to reduce spinal loads
 - Hanging with the knees bent resulted in lower average spine loads
 - It imposes less spinal load because the body is hanging in tension
 - The hanging exercise is best and safest to work muscles while lowering the risk of back problems

86. How do strongman competitors and rugby players reduce joint torque during pushing and pulling activities?
- Enhancing foot grip
 - Increase grip strength
 - Rotate through the lumbar spine
 - Strengthen the gluteals
87. Which exercise resulted in the most activation of the serratus anterior?
- Push-ups on an exercise ball
 - Body Saw
 - Ballistic push-ups
 - Push-ups using suspension straps
88. Which of the following back extension exercises places the highest load on the spine?
- Kneeling on all fours and extending one leg at the hip
 - Using a roman chair or bench to perform torso extensions
 - Lying prone and simultaneously extending and lifting both legs and both arms
 - Kneeling on all fours and extending one leg at the hip and extending the opposite arm at the shoulder
89. What is the first part of the body that should activate when using the TRX suspension straps for pushing/pulling exercises?
- Flex the elbows
 - Depress the scapula and activate latissimus dorsi
 - Retract the scapula and engage the abs
 - Radiate forearm force to the hands
90. Who had more spinal loading on the elliptical?
- Those with tight hips
 - Those with weak gluteals
 - Those with ligamental damage
 - Those with disc deterioration
91. Who should not use kettlebell swings for their back program?
- Those with tight hips
 - Those with weak abs
 - Those deficient in shear stability of the lumbar joints
 - Those with disc degeneration

92. At what bone quality index would a person be able to safely add one-legged quadruped exercises?
- .03
 - .08
 - .05
 - .09
93. What helped offset the lack of hip abduction strength required on the support hip to complete the super yoke carry in world-class strongmen?
- Ipsilateral QL and abdominal obliques
 - Contralateral QL and abdominal obliques
 - Contralateral erector spinae and ipsilateral QL
 - Ipsilateral erector spinae and contralateral QL
94. Which of the following was not a method proposed by researchers for lifting mechanisms?
- Hydraulic amplifier
 - Lumbodorsal fascia mechanism
 - Intra-abdominal pressure mechanism
 - Valsalva maneuver
95. All of the following have a major effect on conclusions reached about the role of IAP EXCEPT:
- Movement arm used to estimate force
 - Moment at the lower lumbar levels
 - Size of the cross-sectional area of the diaphragm
 - Size of the cross-sectional area of the lumbodorsal fascia
96. Why has research found that the presence or absence of IAP makes little difference on the hooplike geometry of the abdominal wall?
- Because it varies so much from person to person
 - Because they are controlled more by posture
 - Because ligaments play a larger role
 - Because the fascia plays a larger role
97. Exercises requiring full lumbar flexion or bending should not be performed in the morning because:
- The discs in the lumbar spine have increased fluid content in the morning, are more resistant to bending, and are more susceptible to injury
 - The lumbar spine is more flexible in the morning and is therefore more susceptible to ligament injury
 - The discs in the lumbar spine have decreased fluid content in the morning, are more resistant to bending, and are more susceptible to injury
 - The muscles in the back have an increased resistance to bending in the morning and are therefore more susceptible to muscle pulls

98. How long should you wait to do spine exercises after getting out of bed?
- 15 minutes
 - 30 minutes
 - 45 minutes
 - 60 minutes
99. What did Brinckmann, Biggemann and Hilweg find to be the first structure to be injured in laboratory experiments?
- Ligaments
 - End plates
 - Disc annulus
 - Disc nucleus
100. Which statement is false concerning ligaments?
- Landing on the buttocks in a fall will rupture the interspinous complex
 - Neural arch damage increases the risk of ligament damage
 - Falling on the buttocks increases the risk for prolonged disability
 - Damaged vertebrae appears to increase the risk of subsequent ligament damage
101. Evidence suggests that reduction in specific tissue damage can be accomplished by doing all of the following EXCEPT:
- Reduce repeated full-range flexion to full-range extension
 - Allow sufficient recovery
 - Increase appropriate loads to stimulate tissue adaptation
 - Increase seated vibration if one has to sit for long periods of time
102. Which is not a mechanical variable that can increase the risk of low back disorders?
- Too many repetitions of force and motion
 - Prolonged postures
 - Increasing variety in work patterns
 - Mechanical differences between genders
103. Which of the following statements is true regarding the avoidance of injury when performing a lifting activity?
- Bending at the legs when performing a lifting activity greatly reduces the shear load on the spine
 - Maintaining a neutral lordotic curve when lifting recruits the pars lumborum muscle groups and aligns the fibers to support the shear forces
 - Fully flexing the spine when lifting recruits the extensor musculature which provides support for the moment and reduces shear loading
 - Maintaining a neutral spine posture when lifting allows the ligaments to support the moment and reduces shear loading

104. Why is the margin of safety much larger in the compressive mode than in the shear mode?
- Because core muscles engage faster than other muscles in the body
 - Because ligaments are a challenge to tear
 - Because the spine can safely tolerate more compression than shearing
 - Because most workers with back injuries sit most of the day
105. Norman and colleagues' 1998 study found that _____ was a very important metric risk for auto plant workers:
- Age
 - Weakened core muscles
 - Static standing postures
 - High reps of subfailure shear loads
106. Adams and Dolan found in 1995 that passive tissues begin to experience damage with bending moments at what point:
- 90 Nm
 - 60 Nm
 - 2400 N
 - 3200 N
107. What motor control error and cause some of the spine-supporting musculature to drop too low in some individuals?
- Delayed reaction time to adjust to increased loads
 - Shortened reaction time to adjust to increased loads
 - Delayed innervations of core muscles
 - Challenged breathing
108. Pain in the SI joint is often due to the joint itself and what ligament?
- Lumbosacral
 - Sacroiliac
 - Iliolumbar
 - Sacrolumbar
109. Why is bed rest not a helpful option for back injuries as found by McGill and colleagues in 1996?
- It increases fluid to the discs, thus causing them to swell
 - It stiffens the spine leading to more pain
 - It causes the person to decrease the desire to move
 - It decreases the laying down of bone, thus making the spine weaker

110. Which statement is incorrect concerning spine flexion?
- Flexion movement is a kinetic term
 - Flexion moment refers to torque
 - Flexion moment does not depend on whether movement has occurred or not
 - Flexion movement is a kinematic term
111. Which is not considered to be a component of foundation for function?
- Proximal stiffness enhances limb speed
 - Muscle coactivation helps create the ability for micromovements in the joint
 - Abdominal armor is necessary for impact athletes
 - A guy-wire system is essential for the spine to bear load
112. What was the significance of research by Butler and colleagues in 1990?
- That repeated spine flexion will lead to discogenic disorders
 - Disc damages typically occurs before facet arthritis is observed
 - Motor changes always occur after debilitating low back injuries
 - Back pain may or may not be present with sciatica
113. Which two muscles have researchers focused on when documenting motor changes?
- Erector spine and rotatores
 - Longissimus and transverse abdominus
 - Transverse abdominus and multifidus
 - Transverse abdominus and quadratus lumborum
114. Sihvonen and colleagues (1997) noted that abnormalities in EMGs tended to occur in what other muscle besides the multifidus in those with low back pain?
- Lateral spinalis
 - Quadratus lumborum
 - Lateral longissimus
 - Medial iliocostalis
115. In McGill, et al's study with 72 workers in 2003, all of the following were found EXCEPT:
- Those who had back problems had a lack of muscle strength in the torso
 - Low back problems were associated with a larger waist girth
 - Those with a history of back problems had diminished hip extension movement
 - Those with back problems had deficits during challenged breathing

116. The term Crossed Pelvis Syndrome refers to which of the following conditions?
- Inflexible hamstrings and hip extensors with a weak abdominal wall and gluteal complex
 - Flexible hamstrings and tight hip flexors with a weak abdominal wall and gluteal complex
 - Flexible hamstrings and hip flexors with a strong abdominal wall and gluteal complex
 - Inflexible hamstrings and hip flexors with a weak abdominal wall and gluteal complex
117. Using the comparison of the spine to an upright fishing rod secured with guy wires illustrates the role of _____ to spinal stability
- The skeleton and muscular attachments
 - Ligament strength
 - Muscular tension
 - Muscular strength
118. All of the following play a role in calculating potential energy EXCEPT:
- Gravity
 - Height
 - Mass
 - Power
119. How many dimensions of the spine can one examine for the lumbar area?
- 6
 - 36
 - 16
 - 26
120. What is most important in order to survive perturbations from either side?
- Balanced stiffness on each side of the spine
 - Power from the multifidus muscle
 - Strength of the transverse abdominus
 - Strong ligaments
121. Which statement is false about force and stiffness?
- Force can stabilize or destabilize
 - Stiffness is always stabilizing
 - Large increases in stiffness are best if delayed in activation
 - As muscles become more active, in adds to spine stability to a point

122. In order to maintain a proper stability margin of safety when performing tasks, it is typically comprised due to insufficient:
- Force
 - Power
 - Strength
 - Endurance
123. What is considered to be “modest” levels of abdominal wall co-contraction needed to properly handle daily activities?
- 20% MVC
 - 10% MVC
 - 30% MVC
 - 25% MVC
124. Which of the following statements regarding stability and muscular strength is true?
- Multiple muscles play a role in maintaining stability, depending on the requirement of the task being performed
 - The multifidus is the most important muscle in maintaining stability in the spine
 - The multifidus and the transverse abdominis should always be targeted when improving stability in the spine
 - The transverse abdominis should be the targeted muscle for maintaining stability regardless of the task being performed
125. What is the best method to enhance spinal stability?
- Drawing the navel towards the spine
 - Increasing the distance between the navel and the spine
 - Holding your breath while bearing down
 - Flexing the spine to 30% MVC
126. Which of the following is considered a stabilizing exercise?
- Any exercise can be a stabilizing exercise if performed correctly
 - Planks
 - Squats
 - Lat pull-down
127. Which of the following is not considered to be a risk factor for LBD from an epidemiological approach?
- Static work postures
 - Vibration exposure particularly when standing
 - Slips and falls
 - Frequent torso motion and high spine rotational velocity

128. Which of the following is not considered to be a risk factor from tissue-based studies?
- Time of day
 - Repeated full lumbar flexion
 - Slow and controlled ballistic loading
 - Insufficient loading
129. Which is not a personal variable that has been identified as a risk factor for LBD?
- Lower torso muscular endurance
 - Abdominal girth
 - Age
 - Family history
130. The National Institute for Safety and Health (NIOSH) proposed lifting guidelines for the amount of load lifted in the hands in 1981 and revised them in 1993. Which of the following identifies the difference between the 1981 and the 1993 guidelines?
- The 1981 guidelines incorporated a factor for non-sagittal lifts and a factor for object shape
 - The 1993 guidelines incorporated a factor for non-sagittal lifts and a factor for whether or not the object lifted has handles
 - The 1993 guidelines added a provision for the different lifting capacities of men and women
 - The 1993 guidelines are less conservative than the 1981 guidelines in predicting smaller loads
131. What was the crucial task that Snook et al accomplished?
- The creation of tables listing the acceptable loads for men and women for a variety of tasks
 - A 3D model of movements for loads vs. injuries among ambulance drivers and EMTs
 - An accurate psychological assessment tool that can accurately predict LBD among assembly line workers concerning job satisfaction
 - A lab based computerized program to determine muscular endurance vs. risk of LBD
132. Which of the following tools for assessing the risk of back troubles that can result from task demands utilizes a three dimensional goniometer?
- NIOSH approach
 - Lumbar Motion Monitor approach
 - Snook Psychophysical approach
 - Ergowatch approach

133. What has Ergowatch been able to accomplish?
- Training for workers in auto assembly lines who can observe co-workers and properly correct their movements to reduce LBD risk
 - A lobbying organization designed to keep LBD and insurance coverage, including workers compensation, on the front line of proper treatment and appropriate back-to-work rehabilitation
 - A software package that is capable of calculating joint loads in any posture for any combination of lift, lower, push, or pull task and calculate the injury risk
 - Calculations of Euler Angles designed to predict proper orthopedic moments
134. What are possible reasons that Frost and McGill found in their respective studies as to why fitter individuals may have more LBD?
- Fitter individuals tend to focus more on strength training and not on endurance of the core
 - Fitter individuals tend to take on more challenging tasks
 - Fitter individuals tend to have more breathing challenges
 - Fitter individuals tend to complain more about injuries
135. Workers should avoid “end of range” spine motion for all of the following reasons except:
- Maintaining a neutral spine eliminates the risk of disc herniation
 - Maintaining a neutral spine when lifting minimizes shear support
 - Maintaining a neutral spine ensures joint tolerance to compressive forces
 - Maintaining a neutral spine eliminates the risk of damage to ligaments
136. Two important factors to consider to minimize stress on the back when lifting are to:
- Push the load with the foot before lifting to estimate weight, and avoid a fully flexed spine
 - Lift one leg off the floor and to the back when lifting heavy objects and maintain neutral spine
 - Place the load close to the body, and avoid a fully flexed spine
 - Place the load close to the body and avoid a fully extended spine
137. Which of the following lifting techniques would be preferable to use for repeatedly lifting light loads off the floor?
- Knees bent, back straight
 - Squat lift
 - Stoop lift
 - Golfer’s lift

138. One technique that can be used to spare the spine from compressive load is to learn to control the _____ during pushing or pulling movements
- Transmissible vector
 - Muscle forces
 - Perpendicular vector
 - Pushing force
139. It is recommended that lifting be avoided immediately following prolonged stooping or sitting because:
- There is residual laxity in the posterior passive tissues following prolonged flexion that increases the risk of injury to the back
 - The spinal tissues need time to recover from prolonged flexion in order to not compromise spinal stability
 - Prolonged flexion causes a redistribution of the nucleus within the annulus and the risk of annulus damage is temporarily high
 - All of the above
140. At what level did McGill and Hoodless find that posterior ligaments may become involved if the joint is fully flexed prior to twisting?
- L5-S1
 - L3-4
 - L4-5
 - L3-S1
141. Which of the following statements is FALSE concerning blackouts while heavy lifting?
- The mechanism for blackouts is very clear
 - It may be caused by an increase in cerebrospinal fluid pressure
 - It is not an uncommon occurrence
 - Central nervous system fluid pressure increases may be the cause
142. All of the following strategies to reduce back problems caused by prolonged sitting are true except:
- Use a foot rest so that the knees and hips are bent to 90 degrees
 - Use an ergonomic chair that can be easily adjusted to accommodate posture changes
 - Get up from a seated position, stand in a relaxed posture for 10 to 20 seconds, and raise the arms overhead and stretch
 - Perform an exercise routine sometime during the day preferably at a time other than first thing in the morning

143. Which of the following is not a known mechanical change associated with the seated posture?
- Decrease in posterior annulus strain
 - Increased compressive loading
 - Decrease anteroposterior stiffness
 - Increase in shearing movement
144. The recommended break from sitting involves standing for how long to give the back a break?
- 30-60 seconds
 - 5-10 minutes
 - 10-20 minutes
 - 10-20 seconds
145. What should athletes who sit on the bench between plays do in order to decrease the risk of LBD?
- Sit in a chair that has a flat seat pan
 - Stand the whole time instead of sit
 - Stand and pace every 20 minutes
 - Sit in lower seats to lift the knees above the hips
146. All of the following are recommendations by the author when using back belts EXCEPT:
- Belts are beneficial for all regardless of whether they have had a back injury or not
 - Belts appear to increase IAP
 - Belts can either increase or decrease spine load
 - Those who are injured while wearing a back belt are usually injured more severely than if they had not worn the belt
147. Which statement is FALSE concerning back belts?
- Many claims have been made concerning their ability to reduce injury
 - OSHA regulates back belts and their use
 - There are no regulatory requirements for back belts
 - Companies that sell and manufacture back belts are not required to conduct clinical trials
148. What did the 1994 NIOSH report conclude about back belts?
- They provide protection for those who have not been injured
 - They do not prevent injuries
 - They are not typically worn properly
 - Manufacturers need to provide better instructions as to how to wear the belts

149. All of the following are valid biomechanical principles workers can use to prevent back injuries except:
- When lifting, use either a squat lift or a stoop lift and keep the load close to the body
 - Avoid lifting or forward bending shortly after getting out of bed
 - Always lift a load slowly and smoothly
 - Break up long periods of sitting by standing up at least every 50 minutes and adjusting seated posture frequently
150. The author recommends the following mandatory conditions for prescription of a back belt as all of the following EXCEPT:
- A full ergonomic assessment of the client's job should be conducted prior to prescribing a back belt
 - Belt wearers should all receive education on proper lifting techniques
 - All belt wearers should be screened for cardiovascular risk by medical personnel
 - Belts should be considered for long term use
151. Which of the following is not recommended in order to prevent injury?
- Avoid a fully flexed spine
 - Keep the external load close to the body
 - Design work that facilitates variety
 - Keep your spine power high
152. What body type tends to do better with firm mattresses with a pillow top?
- Asian
 - Mesomorphs
 - Angular
 - Rounded
153. All of the following are appropriate tips for the consultant EXCEPT:
- Focus on the most demanding tasks
 - Teach movements as a complex movement skill
 - Do not focus exclusively on the musculoskeletal issue
 - Use terms and principles that are easily understood
154. Which of the following is not recommended when working with athletes to reduce the risk of LBD?
- Follow up to assess program efficacy
 - Monitor the athletes at least every 2-3 months
 - Understand the challenges of the team and the sport
 - Devise a player assessment protocol relevant to the sport

155. Which statement is FALSE concerning testing the back?
- Strength training is not recommended early in the rehab program
 - A good score for back strength requires a stable spine
 - Strong hips require less mobility in the back
 - Bodybuilding principles go against rehabilitation clinical wisdom
156. Neurotrophin-3 production has an analgesic effect in:
- Cutaneous and deep tissue pain
 - Ligaments
 - Discs and muscular system
 - Central nervous system
157. What situations benefit from manual therapies?
- Ligament and aponeurosis elements
 - Thorocolumnar fascia
 - Fascial and muscular elements
 - Discogenic and ligament
158. Who will complete all 5 stages of the back training program presented in this book?
- Athletes
 - Office workers
 - Dedicated patients
 - Those with the worst pain levels
159. Which stage of the back training program focuses on spine stability?
- 1
 - 4
 - 2
 - 3
160. Training for health for the low back program requires all of the following EXCEPT:
- Motor control perfection
 - Muscular strength
 - Maintenance of spine stability
 - Muscular endurance
161. A _____ can be used to gauge the tolerance and effectiveness of an exercise added to the program of a patient with a back injury.
- Range of motion increase
 - Positive slope of improvement
 - Pain tolerance rating
 - Muscular strength increase

162. Which of the following is not a valid technique to use to help an individual recognize neutral spine and separate hip rotation from lumbar motion?
- Have the person place one hand on their stomach and the other hand on their lower back to help feel the motion occurring in the hips
 - Hand out written instructions that outline how to perform a task correctly
 - Place a stick along the person's back and instruct them to flex the hips forward but maintain contact with the stick over the spine
 - Show pictures of a task being performed first with incorrect posture, then with correct posture
163. When individuals have a hard time remembering the protective neutral spine pattern, they are told to do all of the following EXCEPT:
- Place both hands on the abdomen
 - Stop before an exertion
 - Practice a few knee bends before the lift
 - Create motion with the hips and not the lumbar spine prior to the lift
164. All of the following statements regarding abdominal bracing and abdominal hollowing are true except:
- When bracing, the muscles of the abdominal wall are activated to make them stiff without drawing the abdomen in
 - Bracing activates the three layers of the abdominal wall which enhances stability
 - Hollowing in the abdominal wall recruits the transverse abdominis which stabilizes the spine in bending and twisting activities
 - Abdominal bracing, which activates the obliques, enhances stability using the oblique cross-bracing
165. When teaching abdominal bracing, and good cue is to:
- Place fingers on the lateral obliques and push the fingers out laterally when stiffening
 - Draw the navel in towards the spine
 - Place fingers at the edge of the rectus abdominus and push the fingers inward while stiffening
 - Bear down as if doing a valsalva maneuver and hold your breath
166. Which is not a proper recommendation when using mental imagery?
- Perform motions slowly chunking them into segments
 - Have the patient self-palpate the specific muscles involved
 - Practice the imagery while performing the task
 - Use a mirror

167. Many patients who do not rehabilitate properly do not _____ during squatting activities, and it is recommended the _____ exercise be used to train them to use these muscles
- Activate their gluteals; leg press machine
 - Activate their gluteals; one-legged squat
 - Activate their hamstrings; leg press machine
 - Activate their hamstrings; one-legged squat
168. Which statement is incorrect when activate the gluteus medius?
- Use the clamshell exercise as a strengthening exercise
 - When the patient is on their side, the thumb is on the ASIS
 - The tips of the fingers should be on the gluteus medius
 - The purpose of the exercise is to simply activate the gluteus medius
169. When performing the bridging exercise, what athletes tend to be hamstring dominant thus activating this muscle before the gluteus maximus?
- Basketball players
 - Long distance runners
 - Swimmers
 - Cyclist
170. The single-leg squat challenges all of the following muscles EXCEPT:
- Hip abductors
 - Hip flexors
 - Hip adductors
 - Hip extensors
171. What is typically the first faulty motion when rising from a chair?
- Extended hips
 - Flexed spine
 - Failure to straighten the knees
 - A forward head thrust
172. Stage 2 of the low back program begins with:
- Muscle re-education
 - Motor control
 - Flexibility
 - Stabilization exercises
173. How do you as the consultant best clarify the rage of activities when focusing on stabilization motion patterns?
- Physically assessing the client
 - Observing the client when they do not think they are being watched
 - Interviewing the client
 - Talking to co-workers about their job responsibilities

174. When focusing on stage 3 for endurance, positions should be held no longer than:
- 7-8 seconds
 - 15-30 seconds
 - As long as possible
 - 30-60 seconds
175. How should you as the consultant judge your success with a client?
- Use the NIOSH disability ranking system
 - Use a questionnaire and interview techniques
 - How well the client can complete tasks with little pain
 - Review workers compensation files on the client
176. MRIs have shown all of the following occur while performing sit-ups with the knees flexed EXCEPT:
- A reduction in spine load is still questionable
 - The psoas is lengthened while the hip flexes
 - The psoas line of action does not change as a result of lumbar or hip posture except at L5-S1
 - Full sit-ups still raise a question of whether it is safe due to the excessive loading on the spine
177. Which statement is true about developing spine flexibility?
- Some individuals may never reach the stage of having spinal flexibility
 - Spinal flexibility should be emphasized before stability
 - Good spinal flexibility decreases the risk of back problems
 - Exercise goals and injury history play very little role in determining when to emphasize spinal flexibility
178. When should lumbar flexion be removed for most patients in order to improve low back pain?
- In the evening
 - In the morning
 - Just before bedtime
 - In the afternoon after sitting for lunch
179. Which of the following statements is FALSE concerning strength?
- Strength is typically reserved athletic performance objectives
 - Strength is not important for recuperation
 - It is not a significant predictor of first time back injury
 - It has little to do with overall back health

180. Which of the following is not a consideration of ordering exercises within a session?
- Flexibility
 - Loading memory
 - Viscosity
 - Stabilizing motor patterns
181. How much fluid in a disc is lost over the course of a day?
- 90%
 - 75%
 - 50%
 - 25%
182. Which of the following is not a valid objective to be considered when designing an exercise program for back health?
- None of the exercises in a program should be so strenuous as to cause pain
 - Low back exercises should emphasize strengthening the back by progressively increasing resistance
 - Exercise programs for back health should include a cardiovascular component
 - Low back exercises should be performed daily
183. Provocative testing is performed to identify _____ and is used to help determine _____.
- Which twisting and turning movements cause pain; which exercises should be used by the patient to strengthen the muscles in the painful area
 - Which postures, motions, and loads are pain free; which exercises to include in the patient's program
 - Which postures, motions, and loads cause pain; pain-free therapeutic exercise to include in the patient's program
 - None of the above
184. All of the following are helpful for the clinician to know EXCEPT:
- More involved tests are very reliable
 - Comorbidities can mask back pain
 - Observations are modulated by the prior loading history of the patient
 - Perception and personality of the client can influence the presentation of the injury
185. Pain the increases during the day usually indicates:
- That loading causes cumulative symptoms
 - That discs are involved
 - That the injury is a new one
 - That the person lacks strength

186. Who is at a lower risk for developing discogenic trouble?
- Telemarketers
 - Computer programmers
 - Dog walkers
 - Secretaries
187. A client who likes to twist the spine in order for it to crack would give higher priority to which activity?
- More repetitions than prescribed
 - The minimal amount of repetitions
 - Yoga
 - Weight lifting
188. When considering dermatomes, decreased pain in the big toe and lateral calf with ankle eversion mytomes may indicate problems at:
- L1-2
 - L5
 - L4
 - L3
189. Muscle pain usually peaks how many hours following a trigger?
- 1-2 hrs
 - 12-16 hrs
 - 24-48 hrs
 - Immediately following the trigger
190. Stenosis symptoms may be confused with:
- Sciatica
 - Claudication
 - SI joint dysfunction
 - Muscular strain
191. Who tends to stand with no measurable extensor or abdominal muscle activation?
- Athletes in combat sports where punching in the abdomen is common
 - Swimmers
 - Cyclist
 - Those with thick torsos and flaccid abdominal walls
192. Which of the following is not an indicator that walking exacerbates low back pain?
- Swinging arms for the elbows
 - Larger steps
 - Duck feet
 - Low-cadence shuffle

193. When performing the heel-drop test, a positive pain response would be indicative of all of the following EXCEPT:
- Herniated disc
 - Cancellous bone damage
 - Osteoporotic wedge fracture
 - Recent end plate damage
194. Posterior disc herniations generally tolerate compression better when the spine is:
- Slightly rotated to the opposite side of the herniation
 - Extended
 - Flexed
 - In neutral
195. Patients who perform the McKenzie posture test and are classified as “posterior discogenic” should avoid:
- Flexion stretches
 - Extension stretches
 - Weight bearing flexed spine exercises
 - Both a and c
196. The scoliosis tests reveals:
- If the scoliosis is correctable
 - If it is caused by a short leg
 - If a nerve impingement is involved
 - The degrees to which the spine is curved
197. The _____ test can be used to determine if a patient might benefit from nerve flossing.
- McKenzie posture test
 - Sitting slump test
 - Flexor or back extensor test
 - Supine passive leg raise test
198. Which statement about the Fajersztajn Test is FALSE?
- Pain in the symptomatic side is a sign of malingering
 - The test should always be performed on both sides
 - Sometimes pain is provoked when cervical flexion is added
 - Pain in the side where the leg is not raised could indicate a central lesion of the disc
199. A positive underhook may explain why:
- Scoliosis is able to be corrected
 - Femoral nerve roots become involved in painful dermatomes
 - The stork test is positive even though a client is not complaining of pain
 - Some flossing required modified cervical postures

200. When performing the supine passive leg raise test, adding cervical spine flexion making the pain worse while lowering the leg leading to a reduction in pain is indicative that:
- The nerve is flossing
 - The disc is posteriorly herniated
 - The iliolumbar ligament is damaged
 - Spinal stability weakness is the main problem
201. Ely's sign is when:
- When the pelvis rolls towards the knee being flexed and the thigh in externally rotated
 - When the pelvis rolls away from the knee being flexed and the thigh is internally rotated
 - When the pelvis rolls away from the knee being flexed and the thigh is externally rotated.
 - When the pelvis rolls towards the knee being flexed and the thigh in internally rotated
202. How are the cervical nerve roots different from the lumbar roots?
- Lumbar roots have separate pain and sensory roots
 - They are more susceptible to whiplash
 - Pain and weakness re more correlated with function associated with the cervical roots
 - Lumbar nerve roots have ligamentous connections to vertebrae
203. The pathology for foot drop occurs at which nerve root:
- L1
 - L2
 - L3
 - L4
204. When the patient is asked to slightly raise their legs off the floor while completing the manual test for lumbar joint stability, they will contract their _____ to determine if this reduces any shearing instability and eliminate their pain.
- Rectus abdominis and obliques
 - Back extensor muscles
 - Back flexor muscles
 - Hip flexor and hamstring muscles
205. What is the typical indicator of hip pathology?
- Pain in the anterior and medial thigh
 - Tingling and numbness down the posterior thigh
 - Pain in the posterior and medial thigh
 - Tingling and numbness down the anterior thigh

206. When performing the hip flexion and rotation tests, what is considered to be a positive sign?
- Numbness when the hip is internally rotated
 - Stiffness and pain when the hip is externally rotated
 - Hyperflexion of the hip
 - Stiffness and pain when the hip is internally rotated
207. The author found that a positive SI joint pain result occurs when:
- Pain when rising from a chair
 - Pain when performing lunges
 - Pain when extending the hip
 - Pain when lifting a moderately weighted object
208. Which of the following is a strategy to determine pelvic ring instability?
- Increase in pain upon manual compression especially while walking
 - Increase in pain when lying supine and the hip is flexed
 - Reduction of pain when manual compression is applied while walking
 - Reduction in pain when lying supine and the hip is flexed
209. All of the following are at risk for developing pelvic ring instability?
- The client who began a walking program with a significant amount of hills
 - Post-partum women who have returned to vigorous exercise too soon
 - An individual who recently had a car accident
 - The client who added 2 more sets of loaded split squats
210. Where is a common location for hinges to occur?
- Thoracolumbar junction
 - C5-T2
 - L5-S1
 - Greater sciatic notch
211. In the flexion response test, all of the following are normal responses except
- Shows silence in the erector spinae muscles
 - Pulls with the obliques while flexing forward
 - Does not shut off the erector spinae muscles
 - Both A and B
212. The challenged breathing test is used to:
- Test a person's fitness level
 - Test a person's ability to take in sufficient oxygen when performing tasks requiring heavy breathing
 - Test a person's ability to increase their breathing rate sufficiently to complete tasks that require a higher physiological work rate
 - Test a person's ability to maintain spine stability during challenged breathing

213. The muscle groups involved in spinal stability during almost all tasks are the:
- Torso flexors, extensors, and lateral musculature
 - Torso rotators and lateral musculature
 - Torso flexors and extensors
 - Lateral musculature
214. Which of the following is an incorrect procedure for the flexor endurance test?
- Hands are folded across the chest
 - Pull the jig back 2 inches
 - The jig is angled to 55 degrees
 - Knees and hips are flexed to 90 degrees
215. The back extensor test is performed by:
- Lying prone on the floor and lifting the feet up and down
 - Lying prone on a table with the feet suspended out over the end of the table
 - Lying supine on a table with the upper body suspended out over the end of the table
 - Lying prone on a table with the upper body suspended out over the end of the table
216. Which statement is FALSE concerning normative data?
- Extensor endurance is diminished relative to both flexors and lateral musculature in those with lingering troubles
 - Men have more endurance than women in the extensors
 - Once back trouble begins, the endurance among anterior, lateral, and posterior musculature is upset
 - Endurance testing should be done once the patient is pain-free
217. Which of the following is not considered to be a typical discrepancy that suggests unbalanced endurance?
- Extensor strength-extensor endurance greater than 4.0
 - Flexion-endurance less than 1.0
 - Right side bridging vs. left side bridging endurance greater than 0.05
 - Side bridge (either side)-extension endurance greater than 0.75
218. Which of the following is considered to be the most important ratio?
- Flexibility-to-endurance score
 - Strength-to-strength score (anterior vs posterior)
 - Strength-to-strength score (left to right side)
 - Strength-to-endurance score

219. Nelson-Wong and Callaghan found that the group to develop pain first when standing were the ones who:
- Had poorer extensor strength vs extensor endurance
 - Had poorer side bridge endurance scores
 - Had poorer flexion-extension endurance
 - Had poorer seated neutral posture endurance
220. All of the following statements describe reasons why traditional exercises for the low back may or may not be beneficial except:
- Sit-ups can load the spine with over 3000N of compression to a fully flexed lumbar spine
 - The posterior pelvic tilt can increase the risk of injury by flexing the lumbar joints and loading passive tissues
 - Flattening the lumbar back to the floor when performing abdominal exercises protects the back and increases abdominal strength
 - Increasing flexibility or lumbar joint mobility can lead to more back injury, not less
221. Which of the following is a correct back sparing technique to use when performing hip and knee work, such as lunges?
- Maintain an upright torso
 - Extend the torso backward as the front leg lunges forward
 - Keep the back leg straight
 - Both a and c
222. Which of the following best describes the cause of sciatica?
- Flexing the spine or hip when a nerve is impinged causes the nerve to snap through rather than slide through the foramen creating pain
 - An impinged nerve cannot slide through the foramen with hip flexion, spinal flexion or knee extension and the nerve is stretched creating excessive nerve tension and pain
 - An impinged nerve cannot slide through the foramen with hip extension, spinal extension or knee flexion and the nerve is stretched creating excessive nerve tension and pain
 - None of the above
223. “Flossing” the nerve is based on the ability of the nerve to:
- Move in one direction in order to enlarge the impinged area enough to diminish nerve tension and pain
 - Stretch to the point that it no longer has to move and pain is eliminated
 - Chemically dissolve the tissues impinging them when they are moved back and forth even in a limited range of motion
 - Decrease in size until they can pass through the tissues creating the impingement

224. Which of the following statements regarding the flossing technique is true?
- If flossing exacerbates the sciatic symptoms and they worsen, it should be eliminated from the patient's program
 - Flossing will always provide relief from sciatic symptoms if it is carefully monitored
 - Even if flossing initially causes pain, the pain will diminish as the procedure is repeated
 - If minor sciatic symptoms are felt, the range of motion in the cervical spine should be increased to maximize the benefits of the procedure
225. How can you make flossing more advanced?
- Add arm movements
 - Keep the neck immobile
 - Perform it standing
 - Perform it with both legs at the same time
226. The authors EMG and modeling studies found that which muscles play a role in stabilization of the back?
- All torso muscles
 - Rectus abdominus and erector spinae
 - Internal and external obliques
 - Quadratus lumborum and rectus abdominus
227. All of the following reasons why the prone back extension exercise is contraindicated for anyone at risk for low back injury are valid except:
- Extending the arms and legs simultaneously results in over 6000N of compression to a hyper-extended spine
 - Placing the hands on either side of the head rather than extending them does not alleviate the compression on the back
 - Performing this exercise stretches the interspinous ligaments
 - The load on the back is transferred to the facets of the vertebrae
228. Which of the following exercises had the highest level of psoas activity and is not recommended as an appropriate abdominal exercise?
- Side bridge
 - Curl-ups
 - "Bird dog" back extension
 - Press heels sit-up
229. Studies performed by the author has found that when it comes to the rectus abdominus:
- There is no function difference between the upper and lower portion
 - The upper portion is more easily activated
 - The lower portion is typically weaker in those with LBD
 - It is impossible to activate the upper and lower portion together

230. What is the better way to activate the obliques?
- One leg bent curl up
 - Side bridge
 - Forward plank
 - Reverse plank
231. Which exercise best trains back extensors?
- Captains chair back extension
 - Forward plank
 - Bird dog
 - Good mornings
232. What should be the first exercise performed in the beginner's program?
- Partial squats
 - Walking
 - Bird dog
 - Cat-camel exercise
233. When performing the partial squats, the pelvis is directed downward and posterior along at degree line?
- 15
 - 25
 - 30
 - 45
234. What is the proper order of exercises for the beginner program?
- Walking, lateral torso, extensors, anterior abdomen
 - Extensors, lateral torso, anterior abdomen, walking
 - Anterior abdomen, lateral torso, extensors, walking
 - Walking, anterior abdomen, lateral torso, extensors
235. Which procedure is incorrect when performing the beginner curl-up?
- Do not flatten the back to the floor
 - The focus of the rotation is in the thoracic spine
 - Both legs are bent with the knees flexed to 90 degrees
 - The cervical spine should remain mobile
236. If a patient experiences neck discomfort while performing curl-ups, they can?
- Place both hands behind their head
 - Place their hands to the sides of their head with the fingertips lightly touching their temples
 - Place their tongue on the roof of their mouth behind their front teeth and push the tongue upward
 - Place their hands behind the lumbar region of their back for support

237. Which of the following describes incorrect form for performing curl-ups?
- One leg is kept bent to 90 degrees while the other leg is extended
 - Focus the rotation on the thoracic spine
 - Leave the elbows on the floor while elevating the head and shoulders a short distance off the floor
 - Flatten the back to the floor
238. The _____ exercise is used to maximize activation of the spine stabilizer muscles and minimize spine load.
- Advanced curl-up
 - Side bridge
 - Prone back extension
 - Bird dog
239. Which of the following modifications of the side bridge can be used with patients unable to tolerate the shoulder load?
- Perform the bridge with the hand on the floor and the arm fully extended to support the upper body
 - Lie on the floor with the legs straight and straighten the torso until the body is supported on the elbow
 - Stand on a 45 degree bench with the feet anchored and lift the upper torso off the pad
 - Both a and c
240. When properly supported in the intermediate side bridge position, the quadratus is active up to what %MVC?
- 70
 - 50
 - 40
 - 60
241. How do you ensure that the pelvis does not lead the rib cage during the rolling for the advance side bridge?
- Imagine a string coming out of the top of the head in order to pull the body into neutral
 - Engage the gluteal muscles
 - Activate the upper rectus abdominus
 - Place your hand on the iliac crest with fingers touching rib cage
242. Common mistakes made during the bird dog include all of the following EXCEPT:
- Hiking the hip
 - Looking at an angle to keep neck in neutral
 - Twisting the spine
 - Flexing the spine

243. Which of the following describes the correct way to perform the remedial bird dog exercise used for individuals with very de-conditioned backs?
- Start on the hands and knees; lift one hand off the floor about ten inches and slightly flex the back
 - Start on the hands and knees; lift one hand and the opposite knee as high as possible and hold for 7-8 seconds
 - Start on the hands and knees; lift one hand off the floor about an inch and hold for 7-8 seconds
 - Start on the hands and knees; lift one knee off the floor about five inches and rotate the leg out to the side
244. How can the client reduce the tendency for hip hiking during the intermediate bird dog?
- Plantarflex the foot
 - Slightly flex the knee
 - Make a fist
 - Round the back slightly
245. What is the best way to challenge the client while performing the advanced bird dog exercise?
- Sweep the floor with the hands and knees
 - Lift both arms at the same time
 - Lift the legs so the back is slightly hyperextended
 - Add ankle weights
246. The thoracic kyphotic stretch utilizes what specific stretching technique?
- Active static
 - PNF
 - Passive static
 - Reciprocal inhibition
247. What type of exercise is beneficial for arthritic Stenosis
- Spine flexion drills
 - Rotational drills
 - Spine extension drills
 - Walking in a slightly slumped position
248. What is recommended for patients with claudication?
- Plank exercises
 - Intermittent walking until 60 minutes total can be achieved
 - Bird dog exercises with the hand lifted in a fist position
 - Curl ups with one leg straight

249. When performing the bird dog exercise with a client who has had a knee replacement, it is recommended to:
- Perform it standing while braced against a table
 - Sweep the affected knee over the floor
 - Shift most of their weight to the non-surgical leg
 - Avoid the bird dog exercise and perform supermans instead
250. Which of the following is a variable that increases leg speed?
- Creating strength in pulses
 - Lifting more weights
 - Focusing on core and the ability to stop rotation
 - Focusing on glute strength in order to stop rotation
251. In the authors case studies of great athletes, the best performers had:
- Superior core strength
 - Superior torque force
 - Superior rotational force
 - Superior technique
252. Focusing on optimizing elastic energy storage occurs in what stage?
- 3
 - 1
 - 4
 - 2
253. Which of the following statements is true regarding whether training should begin on a stable surface or on a labile surface?
- Moving from a stable surface to a labile surface causes more co-contraction which can be beneficial when rehabilitating for dynamic movement
 - Beginning exercises on a stable surface increases spine loads which helps to establish a positive slope of improvement
 - Using labile surfaces for training greatly lessens the spine load which makes them appropriate for de-conditioned patients
 - Labile surfaces can be best introduced after the client has achieved spine stability and restored load bearing capacity

254. All of the following are valid reasons for using or not using machines in a training program except:
- Isolating the joints and muscles to be worked helps reduce both the load and the risk
 - On a machine, the body is not required to stabilize itself and use the muscles involved in stabilization
 - The motor patterns learned on machines may not transfer over to tasks that must be done with the body supporting its weight
 - Some machines, such as a back extension or leg press, can impose higher forces and loads on the back causing injury
255. Why do typical back extensor devices impose twice the muscle loading of the bird dog?
- Because gravity is working harder on the muscles
 - Because the trunk is unsupported
 - Because the equipment is not designed properly
 - Because both left and right side extensors are activated
256. The curl-up exercise can be advanced to its highest level by:
- Lifting the head and shoulders as high as possible
 - Keeping both legs extended on the floor
 - Holding a weight behind the head as it is lifted
 - Adding deep breathing in the “up” position while maintaining bracing
257. Which exercise is considered to be the highest level exercise?
- Stir the pot
 - Back extensor on device
 - Seated back extension machine
 - Rotary torso machine
258. Which statement is incorrect concerning the overhead cable pull exercise?
- Enhances stiffness in the anterior chain
 - Safe for beginners to do
 - Requires motion to stay about the hips
 - Enhances strength of the anterior chain
259. The recommended exercise for maximum activation of the back extensor muscles is the:
- Back extension performed lying prone over a gym ball with feet secured and a weight in one hand
 - Prone back extension lifting the legs only
 - Lying prone on an incline bench with a pad under the torso and a weight in one hand
 - Prone back extension lifting the arms only

260. When training high-performance workers or athletes, which of the following two stages are added to their program?
- Stage 4 for developing muscle endurance and Stage 5 for enhancing strength
 - Stage 4 for enhancing strength and Stage 5 for developing endurance
 - Stage 4 for enhancing strength and Stage 5 for establishing power
 - Stage 4 for establishing power and Stage 5 for enhancing strength
261. Which of the following statements regarding athletes and low back disorders or injury is true?
- Athletes who weight train with resistance machines tend to have fewer back problems during challenged breathing
 - Tall athletes are less able to maintain spinal stability during challenged breathing than short athletes
 - Shorter athletes are less able to maintain spinal stability during challenged breathing than tall athletes
 - Athletes who focus on aerobic endurance training have fewer back problems during challenged breathing
262. What happens during deep inhalation?
- Core stability is enhanced
 - Abdominal wall muscles relax
 - Torque force on lumbar ligaments is increased
 - Abdominal wall muscles engage
263. Pull patterns usually begin with:
- Overhead presses
 - Planks
 - Push-ups
 - Pull-ups
264. Push patterns generally begin with:
- Chin ups
 - Overhead presses
 - Core stability
 - Push ups
265. Lift patterns begin with:
- Shortstop squat of weight elevated on blocks
 - Lunges
 - One-legged kettle bell lifts
 - Box squat jumps

266. What would disqualify adding hand loads to lunges?
- Golfers
 - Those lacking torsional rotational stoppage
 - A history of SI joint dysfunctions
 - Tennis players
267. One method to use to establish spinal stabilization patterns with deep breathing demands is to:
- Have the athlete ride an exercise bike at an intensity to elevate breathing and then immediately dismount and perform a side bridge
 - Have the athlete run a mile as fast as possible and at the end of the run immediately complete an advanced bridge
 - Have the athlete perform bridges moving from one side to the other until breathing is elevated and then hold the posture for 7-8 seconds
 - Have the athlete ride an exercise bike at an intensity to elevate breathing and then immediately dismount and perform cable pulldowns
268. Which of the following statements best explains why wearing a weighted back pack and walking for an hour or more helps improve the back problems from prolonged sitting?
- Wearing a weighted back pack helps strengthen the back muscles
 - The weighted back pack and walking builds endurance in the spine flexor muscles
 - The weighted back pack acts as a counter weight to extend the spine and bring the torso upright which helps reduce spine loading
 - Wearing a weighted back pack builds endurance in the spine extensors
269. Which of the following exercises is recommended for training for torsional capacity?
- Take a push up position, lift one arm off the floor and at the same time rotate the hip upwards
 - Support the upper body with one arm while raising a weight with the other arm and abdominally bracing during the movement
 - Sit in a torsional machine and twist the upper body against resistance
 - Hold a medicine ball in both hands and swing the ball from side to side twisting the upper torso
270. Top-end speed for most sprinters is usually limited by:
- Lack of training the psoas muscle
 - Lack of hip extension power
 - Recovery of the leg in hip flexion
 - Weakness in the transverse abdominis

271. Which of the following statements are true regarding training programs for athletes?
- Exercises designed for sports performance enhancement often require a high spine load
 - Maintaining a neutral spine position and fully braced torso musculature is the best posture to withstand elevated spine loads
 - When training to perform squats and power cleans, young athletes need to learn how to maintain a neutral lumbar spine before adding weight to their training
 - All of the above
272. What is a good cue to encourage the beginning of the ascent for the potty squat?
- Spread the floor
 - Extend the arms
 - Sniff the air
 - Roll the hands into pronation
273. What is an appropriate cue while performing isometric exercises for the neck?
- Raise head and shoulders slightly
 - Bring the fist behind the neck
 - Push tongue to roof of the mouth
 - Add full-tide breathing
274. How can a client increase the pain tolerance while performing the remedial side bridge?
- Adjust the distance from the feet to the floor
 - Place a folded towel under the hip
 - Add weights on the waist
 - Keep the head on the floor
275. What modification should be made if the torso twists on the leg lift while performing the advanced bird dog exercise?
- Lift the opposite arm higher to offset the cantilever effect
 - Allow the leg to rest
 - Place a bar across the back to encourage maintaining core
 - Reduce the leg lift height and push the heel away