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Exercise Protocol for Trainers in Fitness Centers

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Exercise Protocol for Trainers in Fitness Centers

by

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Chapter One

Introduction

Back pain and injuries will affect over half of the American population at some time in their lives. These conditions may be acute or chronic and range in their pathophysiology and mechanism of injury. Using improper body mechanics while performing activities in fitness centers may further exacerbate the symptoms associated with the injury. Along with proper body mechanics it is necessary to utilize appropriate ergonomic principles while performing exercise activities in fitness centers. Together, proper body mechanics and ergonomic principles may decrease the risk of further injury and reduce the occurrence of new injuries from arising when exercising.

Personal Trainers and other employees offering expert advice to members at fitness centers on exercise routines and equipment are not always properly trained in ergonomically correct exercises with proper body mechanics. Opportunity for injuries to occur in fitness centers happens as a result of improper training. One of the most common occurring injuries in fitness is low back injuries associated with improper lifting and body mechanics while using the exercise equipment.

The review of literature and interviews with fitness center employees revealed that the majority of personal trainers in local fitness centers are not adequately trained to prescribe safe, ergonomic exercise routines for members who do not have any form of injury or illness, let alone for someone who has or is suffering from a low back injury or pain. The methods of establishing competency for many trainers could include a personal training course over a weekend. Upon completion of the course, they are then certified.
Many trainers do not have the necessary knowledge of anatomy, physiology, ergonomics, biomechanics and/or kinesiology. Limited or incomplete knowledge can result in further injury or causing new injuries to members of the health club.

Due to the scope and magnitude of low back disorders the author chose to narrow her focus of the protocol on members who suffer from herniated discs and lumbar spondylolisthesis as these are the most prevalent diagnoses seen by physicians. The main principles explored and presented in the protocol, may be used for all members of fitness centers to avoid low back pain and injury.

The completion of this scholarly project resulted in an exercise protocol for personal trainers and other fitness center employees to use when helping members with fitness routines. The protocol focuses on areas of ergonomic principles, proper body positioning while working out in the fitness center, an overview of the low back and an overview of low back disorders. The protocol is based on an extensive review of the literature and could be beneficial for personal trainers and other employees at fitness centers but more importantly, the clients who use their centers.
Chapter Two
Review of Literature

Introduction:

Low back aches and pains are becoming an epidemic in the United States. "Low back pain accounts for $30 billion a year and affects 80 percent of Americans. Back pain is second only to colds as a leading reason people see their doctors" (Roy, 1993, para 7). Back pain is difficult to treat and often even more difficult to diagnose because of the unknown etiology of the symptoms. "In the strict scientific sense, modern medical sciences can definitely diagnosis the cause in only about 15 percent of the acute cases" (Salmans, 1997, para 2). However, low back pain can be attributed to overuse and improper body mechanics over time. "It has been theorized that in most cases low back pain (LBP) is due to overuse of musculoskeletal elements causing inflammation and producing pain" (Byrns, 2002, para 11).

A review of the literature indicates that a significant number of trainers and other employees in local fitness centers are not adequately prepared or trained in providing safe exercise routines for individuals who suffer from low back pain and various other disabilities. They often lack the appropriate knowledge needed to provide safety while engaged in weight lifting and cardio exercises. Many trainers do not know what type of exercise to avoid with clientele who suffer various low back disorders. Many trainers also do not know the basic anatomy or mechanism of injury that has caused the low back disorder or how to avoid further exacerbating the low back pain or injury. With this lack
of knowledge, personal trainers and other employees at fitness centers may be causing more injury to an already painful condition of those who suffer from low back disorders. Personal trainers and other employees at fitness centers need to understand the mechanism of injury to the low back and how improper body mechanics and improper prescription of an exercise program can debilitate and create an increased risk of re-injury or further injury to a person who suffers from a low back disorder.

The purpose of this literature review is to examine typical fitness centers in regard to the standard equipment and the type of training received by the personnel at fitness centers to work with customers who have injuries. In addition, to provide an educational approach for personnel to use in the prevention of future injuries and re-injuries that can occur in fitness centers because of improper use and training of equipment. It is necessary for personnel at fitness centers to understand and be properly trained to deal with back injuries/pain, causes of low back pain, mechanisms of injury to the lower back, and the anatomy of the back.

**Fitness Centers**

Today, thousands of people utilize fitness centers for a variety of reasons such as: increasing lean muscle mass, to lose weight and maintain health, and/or to increase quality of life through exercise. “Exercise is utilized to improve health, maintain fitness and is important as a means of physical rehabilitation. Regular exercise also provides significant psychological benefits and improves quality of life” (Larson, 1999, para 12). Whatever the case, fitness centers are the key to overall health and well-being, as “the
role of fitness in preventive health care has been well established over the past 15 years (Telecommunications, 1998, para 2).

To meet the needs of a variety of clientele today’s fitness centers are equipped with various machines, equipment and resources such as cardiac machines, weight lifting machines, free weights, swimming pools, racquetball courts, aerobic classes, and several other forms of exercise. The size and complexity of services provided may vary among communities; however the equipment and other services provided by health clubs are fairly consistent throughout fitness centers.

*Fitness Trainers in Fitness Centers*

Individuals choosing to become members at a fitness center do so expecting to find employees who are knowledgeable about the equipment used in the facility. Members at fitness centers believe that the gym is a safe haven for working out, where there is minimal risk of injuries while performing lifting exercises, cardiac and/or aerobic activity. However, employees and trainers at fitness centers may not be as knowledgeable as members assume. Just because someone works at a fitness center does not mean they are knowledgeable of the dangers inherent with exercising.

There are individuals who may feel that just because they lift weights and have done so for many years, they are qualified to teach others how to do it. It is important to remember that what works for one person may not work for another. These individuals may have been weight lifters for many years, but if they have not been employing the right techniques when training. This can result in teaching others the wrong positioning and placement while lifting, resulting in injury.
Two personnel trainers, one at Life Time Health and Fitness and one at Wyoming Athletic Club, were interviewed to identify the roles and training they received in order to provide services to clientele in fitness centers. Although the two personal trainers interviewed stated that they had the essential knowledge to train individuals with low back problems and many other disorders, this may not be true of all fitness center personal trainers. J. Miller (2003), a certified personal trainer with a bachelor’s degree in exercise physiology, who works at the Wyoming Athletic Club. During the interview Mr. Miller (2003) provided a handout that discussed how personal trainers are being certified but not always qualified. The handout stated (Miller, 2003):

Did you know that a certification for personal training requires no formal education or minimum requirements? All that is needed to become certified is a short multiple choice test given by one of the 290 certifying organizations. Some certifying organizations don’t even test you at all. Anyone who wants to be certified can do so by the end of the weekend. Certifications in the personal training industry have no standards, or minimum requirements, and therefore lack validity. There are many certified trainers who are hardly qualified (Miller, 2003).

Naversen (2000), who is a reporter, performed an undercover study to determine how easy, or hard, it was to become a personal trainer. The author was not a personal trainer and did not have any certification or background in anatomy, kinesiology, biomechanics, or any other health related field for that matter. Out of the eight gyms where the author applied for employment, three of the gyms were willing to hire her. At the end of the
study, the author confessed to the gym managers that she was an undercover reporter and explained she had no formal education in personal training. Naversen (2000) asked why the gym managers were willing to hire her, and she was informed that: “It is easy to find certified personal trainers, but a good grasp of customer service and good organizational skills are something many trainers lack. Certification is a must, it doesn’t really matter what kind” (Naversen, 2000, para 14). Naversen (2000, para 15) concluded her article by saying, “I’m living proof that gym goers should choose their trainers cautiously”. This is important to note because it provides the rationale and the need for fitness centers to provide their members with an exercise protocol for people with low back pain. It is also important to note that if trainers and employees at fitness centers are not qualified to perform such tasks further injury or new injuries may occur.

*Educational Preparation*

Having proper knowledge of the injuries and re-injuries that may occur during exercise training at fitness facilities is very important for all employees who engage in direct training and contact with members at their gym. A lack of knowledge regarding injury and injury prevention as well as knowledge of the basic principles of anatomy, physiology and biomechanics, will result in the continual rise of injuries in fitness centers.

Employees and trainers should also be trained in proper body positioning when lifting weights as well as when using other basic equipment. The article entitled “Weight Training Injuries Can Usually Be Avoided” provides insight into the need for fitness professionals to be well versed in weight training technique and etiquette to decrease the
amount of injury while engaging in the occupation of weight training. If personnel at fitness centers do not know the proper body positioning when lifting, then serious back, knee, and shoulder injuries may occur. In an article entitled “Hands on Weight Training,” Kaplan (1993) states, “There’s an art and science to teaching someone the proper use of weights, and an instructor needs to learn those skills” (para 4).

**Job Expectations and Responsibilities**

In an interview with Rebecca Albertson an employee at Lifetime Health and fitness (September 15, 2003), she stated that, “many of the people I work with do not know much about the equipment and how it works. Most people employed at the facility do not understand proper lifting techniques essential for basic knowledge and safety. Most employees possess no training or knowledge in helping members with injuries or other disabling conditions”. In another interview Jennifer Chadderdon a personal trainer at Lifetime Health and Fitness (September 15, 2003), described one instance where she instructed an employee not to let a client with low back problems on the calf raise machine. Chadderdon noticed that her advice had not been taken, and that the client was using the calf raise machine. This incident exemplifies a common practice shown by employees who lack the basic knowledge for dealing with special needs members in this particular facility.

Employees who work the front counter at Lifetime Health and Fitness (LHF), a local gym in Casper, Wyoming, provide expertise to the members at the club about operating the exercise machines. These employees are the ones who orient new members in proper positioning of strength-training equipment, how to use the cardiac machines and other
equipment in the fitness center. The new employees at the facility are not trained in
equipment use when they are hired. Albertson (2003) shared her initial training
experience when she stated, “No, when I started here they just threw me in and let me
go. If it wasn’t for the knowledge I already had with the equipment, I would not have
known what I was doing”. Albertson (2003) discussed that management expectations for
new employees is “to answer member’s questions about proper lifting and training on
equipment”. Albertson (2003) shared that she “isn’t aware of impairments that members
may have, including low back pain conditions, and thus, does not know how to best
assess and set up a workout program”. When questions like this arise, Albertson directs
the members into the hands of a personal trainer.

Two personal trainers, one at Lifetime Health and Fitness and one at Wyoming
Athletic Club, were interviewed in regard to their thoughts if front desk employees were
well equipped with the knowledge they needed to care for members with low back
conditions. Both trainers responded that they did not believe that these employees had the
knowledge to provide training advice to those members. When the trainers were asked
how well trained they were in treating clientele with low back conditions, both stated that
they felt at ease in treating those type of clients and have established the training essential
to help such individuals. Chadderdon and Jeff Miller (2003) both stated that 80 percent of
the clients they train have some type of impairment. Miller (2003) stated that “about 30
percent of his clientele have or are experiencing low back pain or injuries”. Both went on
to state that without the knowledge they received in their training, they would not be able
to treat those types of clients effectively and safely.
Training that should occur with fitness personnel

When hiring a front desk worker who is expected to assist in showing new members how equipment works, the employer should provide the new employee with training in how each piece of equipment works. If training does not occur, then injuries among members will increase. This is especially important for strength training equipment, such as free weights, plate loaded machines, computerized machines and selectorized machines because of the equipments diverse functions.

Knowing how the different weight lifting equipment works is important for all employees to know because it provides the basic knowledge for understanding what to and not to put clients on and what type of training should be instructed for safe use of each piece of equipment.

Also a personal trainer at the fitness center should provide an in-service for new employees to help guide them in proper equipment use and positioning when using the facilities equipment. This is much the same as Physical Therapists holding in-services for nursing assistants in how to transfer residents safely to decrease injury to them selves and the residents. In all the literature reviewed a common theme of proper training in equipment use was developed because this is what decreases the risk of injury. If an employee is hired and not trained in how to operate the equipment safely, then they are responsible for any injuries that may occur among users of the equipment.

After reviewing an article by Tufts University (2002) entitled ‘Is your trainer qualified for the job’ the following information was found. In order to be qualified to be a personal trainer, which means they have the knowledge necessary to carry out their job safely and
effectively, they need to hold a bachelors degree in exercise physiology or be certified by the American College of Sports Medicine (ACSM) or certified by the National Strength and Conditioning Association (NSCA) (Tufts, 2002). This is because there are thousands of organizations that will certify any one, regardless of knowledge in exercise science, in a matter of minutes or a couple of days. This means that most trainers are not skilled in the area of prescribing exercise programs to individual clients. A research study done by the University of California (2002) found that out of 115 trainers tested on their knowledge of exercise prescription, fitness testing protocols, health screening, nutrition and dealing with special needs clients, only 19 percent held a college degree in exercise science and only nine percent were certified by the ACSM or NSCA (Tufts, 2002). “Only those who held certification by the ACSM or NSCA or had a bachelor’s degree in exercise science got most of the answers correct, meaning an average of 70-85 percent. Everyone else scored below 40 percent” (Tuft’s, 2002, para 2). If this is the case for trainers working in certain fitness centers than further training and testing should occur before they are allowed to work with their own individual clientele.

All personal trainers should know how to treat clients who have back injuries. If they do not then they should refer the client to someone who does know in order to decrease the chance of injury that will, or may occur. It is recommended that fitness trainers receive adequate and appropriate training in the injury prevention and injury relapse process. General or front desk, employees should not have direct responsibility with creating a fitness plan for members, especially for those members with impairments such as low back injuries or pain. This is due to front desk workers lack of knowledge in
anatomy, physiology, biomechanics and kinesiology. These employees, however, can be involved in showing members how the equipment works and how it is operated as long as the managers at the facilities have guided them through training in how all of the equipment works and is operated.

Risks and Injuries at Fitness Centers

Many injuries occur in the weight room, but can be avoided with proper training. An article entitled “Weight Training Injuries Can Usually Be Avoided” focused on injuries that occur in weight-training and how those injuries could be avoided with proper training and knowledge in weightlifting techniques. The leading types of injury in weightlifting are back, neck and shoulder injuries. These injuries are attributed mainly to improper lifting techniques and individuals trying to achieve unrealistic muscular gains. “In pursuit of a muscular and toned body, many people are pushing themselves too hard and in the wrong ways” (Habib, 2000, para 1).

Injuries in weight training and equipment are on the rise. “Injuries involving weight training and equipment rose to more than 980,000 between 1978 and 1998” (Habib, 2003, para 3). This dramatic increase in traumatic injury points out the necessity for proper weight-training technique, particularly as it deals with maintaining joint integrity and strong bones. Proper education and training for facilitators and other fitness instructors is important in ensuring that weight lifting injuries decrease. “Poor technique, lifting too much weight and overdoing it contribute to many injuries to the hands, back and lower trunk” (Habib, 2003, para 11).
Many weight training beginners are not familiar with proper techniques in lifting, thus requiring the assistance of a fitness professional regardless of the employee's status at the fitness center. If proper techniques are not provided to the beginner by the fitness professional, further injury to an already bad back may transpire. “Beginners should always get a fitness instructor or other experienced lifter to show them proper technique and help them set goals, starting slowly with lighter weights and then working up” (Habib, 2003, para 19).

Low back injuries are one of the most common injuries that occur during weight lifting activities. “50 percent of 28 injuries among adolescent power lifters were low back problems” (Raske, 2002, para 35).

Weitz (1997) states, “The mechanisms of injury to the low back include hyperflexion, hyperextension, torsion, and overdevelopment and excessive tightening of the iliopsoas muscles” (para 23). Many injuries to the low back occur when repetitive lumbar spine flexion and extension occur while under load. When individuals lift weights off the floor, they usually bend at the hip to pick up the weight. This causes the lumbar spine to become flexed. When the person lifts the weights off the floor from this position, they are placing much stress and load on the spine, thus increasing the chances of injury to the low back. “The lower back muscles stop contracting when the spine is sufficiently flexed, a phenomenon known as the flexion relaxation response of the erector spinae. It may result in injury to ligaments or discs” (1997, para 24).

Hyperextension injuries may also occur in the low back when performing weight lifting series. “Hyperextension injury to the spine may result from arching backward
while performing unsupported overhead presses, moving into a hyperextended position while performing the back extension exercise ballistically, or while performing prone leg curls” (Weitz, 1997, para 27).

Twisting exercises are also hard on the low back and may increase the risk of injury. A common machine in most fitness centers is the rotary torso machine that targets the transverse abdominal muscles through rotating the torso. This machine is especially taxing to the low back and may cause compression or disc herniation (Miller, personal communication, September 18, 2003).

Another major source of back injury at local fitness centers occurs through abdominal exercises. These injuries occur to the low back through overdevelopment and tightening of the hip flexors and iliopsoas muscles. “When the iliopsoas muscle contracts, it exerts both increased comprehensive and shear forces on the lumbar spine” (Weitz, 1997, para 30). Many of the classic abdominal exercises that people perform regularly and thought were good for trimming down the mid section actually incorporate more hip flexor muscles than abdominal muscles. This occurs secondary to hooking the feet under a stationary object. When a person hooks their feet under an object, they are using the force of their feet to help pull their upper body up into an upright position. When this occurs, the hip flexors become engaged and the abdominals are not doing as much of the work to bring the mid section into a ninety-degree angle.

The primary reason that low back injuries occur during weight training is due to the amount of load placed on the spine during lifting exercises. Other reasons for injury are due to repetitive stress on the tissues and joints. “Many weight training injuries may be
related to stressing the same joints repeatedly until muscular or tendinous failure occurs” (Weitz, 1997, para 8). Weitz (1997) also adds another cause of injury in weight lifting: “poor techniques may result in abnormal wear on joints and over time may lead to cartilage breakdown” (para 8). Poor technique and improper use of equipment are the leading causes of weight training injuries. The scope and magnitude of these injuries increase when health club employees are not adequately instructed in proper lifting techniques.

**Anatomy of the structure of the back**

To further understand low back pain and injuries a description of the skeletal and muscular structure of the back must be explained. First, a description of the skeletal structure will be explored. The vertebral column, or back bone, forms the skeleton of the trunk of the body. “The vertebral column is a strong, flexible rod that both bends anteriorly, posteriorly, and laterally and rotates. It encloses and protects the spinal cord, supports the head, and serves as a point of attachment for the ribs, pelvic girdle and muscles of the back” (Tortora, 2000, p.201).

“The vertebral column makes up about two-fifths of the total height of the body” (Tortora, 2000, p. 201). The vertebral column is made up of a group of bones called the vertebrae. “The length of the column is about 71 cm in an average adult male and 61 cm in an average adult female” (Tortora, 2000, p. 201). “Between the vertebrae are openings called intervertebral foramina. The spinal nerves that connect the spinal cord to various parts of the body pass through these openings” (Tortora, 2000, p.201). The vertebral column is divided up into five regions. ‘These regions are the cervical, thoracic, lumbar,
sacral, and coccygeal’ (Tortora, 2000, p.201). ‘The vertebrae in the lumbar region are the largest and strongest secondary to the fact that this is where the greatest amount of body weight is supported’ (Tortora, 2000, p.209). Knowing about the structure of the vertebrae is important for understanding the many causes of low back pain and injury.

**Anatomy of the musculature of the back**

Now an exploration of the musculature of the back will be defined to allow an understanding of the basic function of the muscles and how they play a part in low back pain and injuries. Many muscles are involved in the movement of the vertebral column and are grouped into the following categories: splenius muscles, erector spinae muscles, transversospinalis muscles, and the segmental muscle groups. Secondary muscles that also play a role in moving the vertebral column are the rectus abdominis, external oblique, internal oblique, and quadratus lumborum.

The splenius muscles arise from the midline and extend laterally and superiorly to their insertions. “These muscles are attached to the sides and back of the neck. They extend the head and laterally flex and rotate the head” (Tortora, 2000, p.353).

The erector spinae muscles “arise from the midline or more laterally but usually run almost longitudinally, with neither a significant lateral nor medial direction as it is traced superiorly” (Tortora, 2000, p.353). This muscle group is the largest muscle mass of the back. “It is the chief extensor of the vertebral column. ‘It is also important in controlling flexion, lateral flexion, and rotation of the vertebral column and in maintaining the lumbar curve, because the main mass of the muscle is in the lumbar region’ (Tortora, 2000, p 353).
The transversospinalis muscles arise tangentially but expand near the midline as they are traced superiorly (Tortora, 2000, p.353). “The semispinalis muscles of this group extend the vertebral column and rotate the head” (Tortora, 2000, p.353). “The multifidus muscles, of this group, extend and laterally flex the vertebral column and rotate the head” (Tortora, 2000, p.353). “The rotator muscles, of the transversospinalis muscles, extend and rotate the vertebral column” (Tortora, 2000, p.353).

The final muscle group to be discussed is the segmental muscles. “These muscles unite the spinous and transverse processes of the consecutive vertebrae. They function primarily in stabilizing the vertebral column during its movements” (Tortora, 2000, p.353).

Knowing the basic anatomy of the body is an important first step in understanding both proper exercise technique, and knowing what to do and not to do with a person who suffers low back pain and injuries.

*The Back*

Understanding and knowing about low back pain and injuries is also important in the development of an exercise protocol for people suffering low back pain and injuries. “Almost all Americans experience low back problems at least once in their life time, and for many persons these difficulties are a recurring problem” (Susman, 2002, para4).

“Low back pain may start with a twinge in the low back, with pain shooting down the leg. Then low back pain can become so severe as to be incapacitating” (Roy, 1993, para 5). There are two main categories of low back pain: acute and chronic. Acute back pain can be described as pain in the lower back that lasts for less than six weeks. “Most lower
back pain (80%) will disappear within six weeks, regardless of any intervention” (Holmes, 1998, para 3). In the acute phase of recovery, rest is recommended for individuals along with allowing the body to heal itself. Holmes discusses that modalities of heat, ice, massage, acupuncture, ultrasound and other methods will alleviate the pain: however, “no proven physiological benefit in accelerating the healing process is provided” (Holmes, 1998, para 3).

Chronic back pain is defined as, “pain in the lower back lasting more than six weeks” (Holmes, para 6). Individuals with chronic back pain will develop recruitment patterns from other muscle groups to pick up the slack of the injured muscles. Individuals use this strategy to guard any movements that allow the back to work. When the back muscles are not utilized, over time, muscle atrophy and weakness will develop. That is why exercise and movement through strengthening and aerobic exercise are necessary. “Increasing your levels of strength increases your structural integrity and your ability to withstand the unguarded movements” (Holmes, 1998, para 7).

*Low back injuries and mechanisms of pain*

A discussion of different injuries that may cause low back pain needs to be examined in order to understand what types of exercise strategies are best performed with different diagnoses. First is the diagnosis of a herniated disc. Meriam Webster’s Medical Desk Dictionary defines a herniation as “a protrusion of an organ or part through connective tissue or through a wall of the cavity in which it is normally enclosed” (1996, p. 335). A herniated disc occurs when “the nucleus pulposus protrudes posteriorly or into one of the adjacent vertebral bodies” (Tortora, 2000, p213). Intervertebral discs act as shock
absorbers in the body. When one of these discs becomes injured and herniation occurs, severe pain may be experienced due to nerve compression. In most cases a laminectomy is performed to relieve pressure on the nerves.

In spondylolisthesis "forward displacement of a lumbar vertebra on the one below it and especially the fifth lumbar vertebra on the sacrum producing pain by compression of the nerve roots" occurs (Merriam Webster, 1996, p762). Arthritis of the bones of the lumbar spine may also be the cause of low back pain. Back spasms are also a cause of low back pain. When spasaming of the muscles in the low back occurs, involuntary muscle contractures cause the muscle to become tight and may compress the nerves in the low back.

**Exercise and low back pain**

In the article entitled, "Physical Activity is Best for Back Pain," Jackson (1997) discusses the importance of physical activity in creating a more healthy back. Jackson (1997) also discusses the misconception of bed rest being the best medicine for individuals suffering low back pain disorders, "careful controlled studies have shown that limited, if any, periods of bed rest are best and physical activity as soon as possible is recommended" (Jackson, 1997, para 1). Bed rest contributes to muscle atrophy, fatigue and tightening secondary to immobilization occurred due to lack of use.

Physical activity is good for many back pain sufferers, however, guidelines placed by doctors need to be followed while engaging in physical activity following acute or chronic back pain. The article also discusses that there is no one means of exercise that
exceeds another in therapeutic efficiency, as long as the activity is within reason and does not aggravate the individual’s back.

The article also discusses reasoning behind why exercise seems to alleviate back pain in sufferers. "Venous congestion and edema around the nerve roots within the vertebral canal and intervertebral foramen develop in relation to mechanical damage in the back" (Jackson, 1997, para 3). The author asserts that exercise alleviates back pain in much the same way that it acts as an assist for individuals suffering from varicose veins or edema of the feet. "Muscular activity will cause an afferent discharge, which may inhibit the transmission of the pain signal in the spinal cord in a similar way as rubbing the site of an injury will relieve local pain. Movement of the spine likewise will lead to afferent impulses, which may relieve symptoms in a similar fashion" (Jackson, 1997, para 5).

Having knowledge of why exercise is effective for persons suffering low back pain, a more comprehensive evaluation is obtained to increase the positive construction of an exercise protocol for low back sufferers. The article also allows for support, through evidence of exercise use, in determining why a back protocol is needed.

*Exercise Protocol for Fitness Trainers*

Due to the lack of knowledge that most personal trainers have, a comprehensive and educational reference would be important for these individuals to decrease the risk of further injury to members with low back pain or disorders. This is why a back protocol would be necessary for trainers working in local fitness centers today.

An exercise protocol would allow for an increase in educational knowledge of what exercises should and should not occur with members who have low back pain associated
with herniated disc and spondylolisthesis. The protocol would allow for a universal tool to use when prescribing and performing exercise regimens with members in the fitness center. This protocol could also be used by trainers who provide training in the home for members who can not make it to the gym.

Back injuries and re-injuries can be prevented with the right amount of knowledge in how these injuries occur. If all trainers and staff at fitness centers work together in understanding and utilizing an exercise protocol these injuries may be diminished and the members being treated by the personnel will have a greater appreciation for exercise.

**Conclusion:**

Due to the complexity and difficulty in treating low back pain and disorders it is important for trainers and personnel at fitness centers to create an environment for individuals to work out in that will decrease the risk of injury and re-injury to the low back. This can be accomplished by increased knowledge in the mechanism of injury to the low back and how improper use of equipment can impair or exacerbate low back pain or injuries.

Low back pain and injuries will continue to be present in many individuals utilizing fitness centers and, thus, it is important that all employees who provide exercise routines and prescriptions to members have knowledge in appropriate technique and execution of equipment use when training members in work out routines.

It was found that many personal trainers do not have proper training in anatomy, physiology, kinesiology, and biomechanics. This opens the window for further or new injury to occur to the low back. This is because if trainers do not know how the injury
occurred or what the pathology of the injury is how is an appropriate and safe workout routine to be devised that takes into account the individual members needs. If the trainer does not understand that with a herniated disc a posterior protrusion of the nucleus propuluses occurs and further flexion of the spine increases the symptoms, further injury will occur.

In conclusion literature reviews and individual interviews, as well as observation have displayed that many of the employees at fitness centers do not have the knowledge needed to develop an exercise program for members who experience low back pain and injuries. This knowledge has provided the support that an exercise protocol for people who experience low back pain and injuries is needed in the local fitness centers in Casper Wyoming.

In chapter three, the process, steps and methods that were used in the development of the exercise protocol will be presented. The process consisted of interviews, literature study and discussion of the information with the scholarly project advisors.
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Chapter Three
Activities/Methodology

The development of the exercise protocol began with meeting with Dr. Scott Johnson of UND/CC faculty and Dr. Lavonne Fox of UND OT faculty to devise an initial lay out of the exercise protocol. The author also had an interview with Shawn McCoul, a physical therapist, to discuss exercises that are appropriate for individuals who suffer from low back disorders. Shawn also provided the author with information that addressed herniated discs and spondylolisthesis. Shawn demonstrated some of the exercise for the spine that can be used with individuals suffering from low back conditions.

Two separate interviews were established; one at Life Time Health and Fitness and one at the Wyoming Athletic Club in Casper Wyoming. It was deemed important to meet with two different personal trainers to determine the need for an exercise protocol of this type and gather their professional perspectives. The interviews resulted in obtaining each personal trainer’s perceived knowledge and comfort with personal training duties and tasks. The process included asking the trainers questions about their expertise and knowledge of working with members who suffer from low back pain and disorders, their educational level/background and credentialing associated with being a personal trainer. The next step consisted of employee interviews that were conducted at the fitness center. The purpose of these interviews was to identify the knowledge and training these employees received on the centers equipment and how appropriately to operate them.
An extensive review of the literature was completed investigating low back injuries, personal trainer’s competence and qualifications, ergonomics, and proper body positioning in the fitness center.

Through an interview with Shawn McCoul it was revealed that various back injuries and disorders have divergent contraindications. After realizing the wide variety of disorders, it was determined by the OTS and her advisor, Dr. Scott Johnson, to narrow the scope of disorders presented in the protocol. The decision was to choose two different low back conditions and expand on these. The disorders chosen for review were herniated discs and lumbar spondylolisthesis because these two are the most common disorders seen in doctor’s offices. The next step consisted of expanding the research on the specific diagnoses to determine the contraindications and pathophysiology associated with each one.

Upon completion of gathering the necessary information and data, the protocol was constructed. The focus of the protocol evolved into the following areas: ergonomic principles, proper body mechanics while lifting, as well as two different sections addressing herniated discs and spondylolisthesis. A draft was sent to Dr. Scott Johnson and Dr. Lavonne Fox for feedback before finalizing the protocol.

It was also suggested to ensure that the protocol was designed to take into consideration the education level of the employees and trainers who would be using it in the fitness center. Appendices were made to include pictures of the concepts or terms that were too medically based for the average person.
The process has consisted of continuous feedback from the advisors, until the final approval was secured with the final copy to be presented to the local fitness center employees and trainers.
Chapter Four

Protocol

EXERCISE PROTOCOL

DESIGNED FOR

FITNESS CENTER EMPLOYEES
Introduction to the Exercise Protocol Units

One of the main areas injured in the gym is the back. Low back pain occurs in 80 percent of the population at any given time in their life. “Low back pain accounts for $30 billion a year and affects 80 percent of Americans” (Roy, 1993, para7). Members utilizing fitness centers may have or have had low back pain associated with some kind of low back disorder. Ergonomic principles and proper positioning when using the exercise equipment will be provided to you in a format that you can use to learn the information and you can use to teach the members of your fitness center. The purpose of ergonomic principles and proper positioning is to help decrease undue strain on the spine.

This exercise protocol is designed to give fitness employees a plan of action that they can use with all members to make their workout as safe as possible and avoid injury. There are four units to this protocol. The first three units have more general information for those employees who do not have additional training and experience with back injuries. The fourth unit has more specific information and medical terminology that is more appropriate for trainers with experience and additional formal training. The four units are:

Unit 1: What is Ergonomics

Unit 2: Introduction to the Back

Unit 3: Introduction to Low Back Disorders

Unit 4: What is Proper Positioning

Each unit includes: a) the title of the unit, b) the objectives of the unit, c) the main ideas and definitions with an explanation as to why the information is important for you to know and d) the specific resources that were used to write the unit.
Unit 1: Ergonomics
Unit 1: Ergonomic Principles

Objectives:
1. To gain an understanding of what the term ergonomics means.
2. To learn ways to apply ergonomics to exercise and weightlifting so the members can do it safely

Ergonomics:

The term ergonomics simply means to change things in the environment to fit each individual person, rather than changing the person to fit the environment. A person's posture, while performing everyday activities, and how they move are the biggest keys to successful ergonomics. “Poor posture and movement can lead to ... stress on the muscles, ligaments, and joints, resulting in complaints of pain in the neck, back, shoulder, wrist and other parts of the body” (Dul, 2001, p.5). Weight lifting is a common way of creating low back pain or re-injuring the low back while exercising in the gym so it is important to use the following ergonomic ideas so injury does not occur.

General Ergonomic Principles to Know
The following ergonomic principles provide a guideline for use in fitness centers to increase safety and decrease injury while performing weight lifting exercises. The guidelines outline proper positioning while lifting weights to avoid injury. They are recommendations that should be used while performing any exercise involving weight training. Use these principles with every member seen to increase the overall success of each members training program. (Principles 1-3 may be found in appendix A at the end of this protocol).
1. *Keep weight as close to the body when placing it on plate loaded machines.*

“If the weight is too far from the body, the arms will be extended and the trunk will be bent over in a forward direction. The weight of the arms, head, trunk and possibly the weight of any load being held then creates a greater parallel pull on the joints under stress (e.g. elbow, shoulder, back). This increases the stress on the muscles and joints” (Dul, 2001, p.6). This means that the person is put in the position of leaning forward and putting the back under a great deal of harmful stress.

2. *Avoid bending forward*

When “the trunk is bent forwards, the harder it is for the muscles and ligaments of the back to maintain the upper body in balance. The stress is particularly large in the lower back” (Dul, 2001, p.6).

3. *Avoid twisting the trunk, it strains the back*

“Twisted postures of the trunk cause undesirable stress to the spine. The stretchy discs between the vertebrae are lengthened and the joints and muscles on both sides of the spine are subjected to one sided stress” (Dul, 2001, p.6-7).

4. *No Sudden movements*

“Sudden movements and forces can produce large, short duration stresses. It is well known that sudden lifting can cause acute back pain in the low back. Lifting must occur as far as possible in an even and gradual manner” (Dul, 2001, p.7).

5. *Limit the duration of any continuous muscular effort*
“Continuous stress on certain muscles in the body as a result of a prolonged posture or repetitive movement leads to localized muscle fatigue, a state of muscle discomfort and reduced muscle performance. As a result, the posture or movement can not be maintained continuously. The greater the muscle effort, the shorter the time it can be maintained” (Dul, 2001, p.8).

Resources:


Unit II: Introduction to the Back
Unit II: Introduction to the Back

Objectives:

1. To gain an understanding of the general structure of the back.
2. Increase understanding of how the back works.

General Overview of the Low Back:

"The natural curves of the spine should be maintained as much as possible throughout activities to avoid unnecessary wear and tear on the spine" (Carhart, 2003, para 1). Figure 3.1 in appendix D shows the natural curves of the spine.

- "The back contains 7 cervical, 12 thoracic and 5 lumbar vertebrae that enclose and protect the spinal cord" (Carhart, 2001, para 1).
- "Between the vertebrae are the discs, the shock absorbers of the spine" (Carhart, 2001, para 1).
- "Ligaments connect the vertebrae and provide stability, but are not elastic. The muscles attaching to the spine control spine movement and are elastic" Carhart, 2001, para 1).
- "Nerves branch off the spinal cord at each vertebral level and travel from the neck to the arms and from the low back to the legs" (Carhart, 2001, para 1).
- "At each vertebral level are facet joints (these joints may be viewed in appendix D on page 77) one on each side, connecting adjacent vertebrae to one another. The facet joints create movement in the spine, much like other joints in the body" (Carhart, 2003, para 1).
“Certain structures in the body are more forgiving than others to injury. Muscles are elastic and heal quickly if injured. Disc’s, joints and ligaments are not elastic, take much longer to heal and don’t recover their strength as well when injured, leaving a person more inclined to re-injury” (Carhart, 2003, para2).

“Using improper posture and body mechanics make muscles have to work harder and puts unnecessary forces on the discs, joints, and ligaments. Once the muscles supporting the spine tire, the discs, nerves and joints become more open to injury” (Carhart, 2003, para4).

This is why using proper ergonomic principles while exercising is important. Using ergonomic principles increases proper body posture and body mechanics, thus decreasing the amount of undue injury to the low back and spinal structures.

Resources:

Unit III: Low Back Disorders
Unit III: Introduction to Low Back Disorders

Objective:

1. To gain an awareness of the symptoms and descriptions of a herniated disc and Spondylolisthesis.
2. To gain an understanding of what exercises to do and to avoid with members who have low back disorders.
3. To learn how to use equipment with individuals suffering from a herniated disc and spondylolisthesis injuries to decrease risk of re-injury.

Herniated Disc Defined

What is a herniated disc?

"The bones that form the spine in your back are cushioned by small discs. These discs are round and flat, with a tough, outer shell (capsule or annulus) that surrounds a jellylike material, called the nucleus. Normally the disc is under pressure and its outer surface bulges slightly" (Mayo Clinic, 2003, Para1). "The discs are constantly being compressed by forces placed on the vertebrae during normal daily activity" (Tortora, 2000, p.213).

"When these discs are healthy, they act as shock absorbers for the spine and keep the spine flexible. When these discs are damaged from an injury, normal wear and tear, or disease, they may bulge or break open (rupture)" (Mayo Clinic, 2003, para 2). "During the normal daily compression that occurs on these discs pressure within the discs may build and also contribute to the nucleus of the disc rupturing" (Tortora, 2000, p.213). "When a disc bulges or ruptures (Fig. 1.1, Appendix D), it is called a herniated disc, or sometimes a slipped or ruptured disc" (Mayo Clinic, 2003, para 2).
“Herniated discs can occur in any part of the spine. More than 90% of herniated discs affect the lower back (lumbar spine)” (Mayo Clinic, 2003, para 3). “It occurs most often in the lumbar region because it bears much of the weight of the body, and it is the region of the most flexing and bending” (Tortora, 2000, p.213). “The remainder occurs in the neck (cervical spine) and rarely in the upper back (thoracic spine)” (Mayo Clinic, 2003, para 3).

**What are symptoms of a herniated disc?**

“Although injury to the outer covering, the capsule or annulus, of a disc can cause pain, often a herniated disc by itself does not cause any pain. Pain occurs when the covering on the outside of the spinal cord or spinal nerves is irritated. Loss of function—such as weakness or altered sensation—can be caused by pressure from the herniated disc on the nerve roots or spinal cord. Pain or numbness may occur in the area of the body to which the nerve travels. For example, a herniated disc that presses on one of the nerve roots of the sciatic nerve—a large nerve that extends from the lower back down the back of the leg—may cause pain and numbness in the leg, a condition called sciatica. Sciatica is the most common symptom of a herniated disc in the lower back” (Mayo Clinic, 2003, para 4).

“The most common presenting complaint is that of shooting pain down one or, although uncommon, both legs. The pain will typically travel from the back or buttocks to below the knee, following the path of a specific nerve root” (Spine Solver, 2003, para1). “Additionally, a patient may experience numbness or weakness with a herniated disc. The numbness is most frequently reported to be in the calf, the sole of the foot or the big toe. The weakness is often experienced by the patient as an inability to walk up the stairs normally or to walk on the toes. The weakness might present as an inability to lift the foot while walking (a "foot-drop"), or weakness in flexing or extending the knee, foot, or leg” (Spine Solver, 2003, para4).
"You may also develop back pain along with a herniated disc and sciatica. Like sciatica, this associated back pain usually subsides over time" (Mayo Clinic, 2003, para 5).

**How is a herniated disc treated?**

"The mainstay of therapy for herniated lumbar disc is conservative treatment, i.e., nonsurgical. This is because in the majority of patients the symptoms resolve or subside to a level allowing normal activity within 4-6 weeks. There are numerous non-operative treatment modalities. Most encompass a combination of bed rest, physical therapy, chiropractic care, and medication" (Foley, 2000, para 11). "About 50% of people with a herniated disc recover within 1 month; after 6 months, more than 95% recover. Only 10% of people with herniated disc problems have enough pain after 6 weeks that surgery becomes an option" (Mayo Clinic, 2003, para 6).

"The age groups of people most affected by herniated discs are those people 30-40 years of age" (Mayo Clinic, 2003, para 8). This is because as we age we lose much of the elasticity and some of the water content of the spine. "People who sit for long periods of time, such as truck drivers, or those who twist their backs a great deal are at a higher risk of getting a herniated disc" (Mayo Clinic, 2003, para 8).

"A herniated disc causes pain, loss of feeling, tingling, or muscle weakness. The symptoms either come and go suddenly or are constant and last a long time. The amount of pressure the herniated disc puts on the spinal nerves determines how bad the symptoms will be. Coughing, laughing, sneezing, urinating, or straining while defecating make the pain of a herniated disc worse" (Medbroadcast, 2003, para 3).
Things to avoid:

- A person with a herniated disc should not bend, strain or lift heavy objects (McCoul, 2003, personal communication).

- Flexion exercises (ones that involve bending at the waist and reaching for the toes) should be avoided. This is because flexion exercises push the nucleus of the disc more posteriorly (towards the back), thereby putting more pressure on the nerve roots that are already being pushed on by the bulging disc. These include activities like: sit-ups on the incline bench, bent over rows, dead lifts and various other flexion inclined exercises (McCoul, 2003, personal communication).

- The recumbent bike should not be used with these individuals as it adds more pressure to the herniated disc.

- The person should not bend at the waist to pick up weights off the floor. The person should bend at the knees and use the leg muscles when lifting the weights off the floor to decrease strain on the low back.

- Avoid the lying leg flexion machine as this causes the spine to flex while lying on the equipment.

Things to do:

- All exercises should be performed in a neutral spine position. This means the back and spine remain straight and in a normal curve when lifting weights, performing cardio exercises and any other parts of the exercise routine.
Any kind of extension exercises are good. Extension exercises are those that allow for extension of the spine to occur. This could be bending backwards or lying on the stomach and pushing up with hands to bend the back in a backward direction. This is because extension exercises help to push the ruptured disc more anteriorly (towards the stomach), thus changing its already posterior direction of dislocation in the spine.

Water programs and swimming are very good exercises. There is no pressure or strain put on the spine during swimming activities and this will decrease the amount of increased slippage of the disc that occurs.

Aerobic exercise on the upright bike, treadmill and elliptical trainer are good. These pieces of equipment do not create a flexed spine and therefore decrease the amount of posterior pull on the slipped or ruptured disc.

When lifting free weights always use proper lifting techniques. (Discussed in the lifting section and weight lifting principles section). Have the person sit on a weight lifting bench with their back supported against the back of the bench. This will decrease the risk of improper positioning while lifting. If the person must stand to lift the weights, make sure they pull in their abdominal muscles to support the spine.

Any weight lifting activities may be performed with these patients but plate loaded squats may put pressure on the low back and cause pain. Listen to the patient’s complaints with any lifting techniques.

Stop the exercise if pain is increased in the low back.
Always stretch before and after your exercise session, especially the hamstrings, low back and thighs, which are the tightest areas of these individuals’ muscles.

When lifting weights, always have the person start out with a low weight and increase the weight load as the person can tolerate. If too much weight is lifted the person may tire easily and they may not use proper form while lifting.

**Things to consider:**

During the initial stage of a herniated disc the person needs to rest the back and not perform strenuous activities that may worsen the symptoms. A person should not have bed rest for over 2-3 days as muscle atrophy may occur, increasing the severity of the herniated disc. Low intensity exercise is important to start performing as soon as the person is able to. Extension exercises are good to perform with the person initially.

**General:**

- Respect pain that the person may have.
- If you are not sure of the person’s condition consult with their physician for contraindications the person may have.
- Consult an Occupational or Physical Therapist for further exercises that may benefit the client if you are not sure what to do.
- Follow the lifting techniques located at the beginning of this protocol.
- Use ergonomic principles (located at the beginning of this protocol) to decrease re-injury to the herniated disc.
- Many Pilate’s poses are good to perform as they strengthen the spine stretch the hamstrings and thighs and strengthen the abdominals and
buttocks muscles. Any moves however that are flexion based, meaning flexion of the spine occurs, should be avoided.
Defining Lumbar Spondylolisthesis

“The word spondylolisthesis derives from two parts - spondylo which means spine, and listhesis which means slippage. So, a spondylolisthesis is a forward slip of one vertebra (i.e., one of the 33 bones of the spinal column) relative to another. Spondylolisthesis usually occurs towards the base of your spine in the lumbar area” (Rodts, 2003, para 2). That is one vertebra is slipped more anteriorly (towards the stomach) over another vertebrae. This may be viewed in Figure 2.1 of appendix D. Usually a fracture on both sides of the pars interarticularis (figure 2.2, appendix D) has occurred (S. McCoul, personal communication, 2003). Spondylolisthesis may be classified into five separate categories: type 1 is congenital, type 2 is isthmic, type 3 is degenerative, type 4 is traumatic and type 5 is pathologic. Each category requires the same activities to avoid in the gym.

Types Defined:

- **Type 1:** “Characterized by the presence of an abnormal growth on the sacral facet joints (figure 2.3 of appendix D) allowing forward slippage of one vertebra relative to another. The direction of the facets in an axial (vertical) or sagittal (middle/straight up and down) plane may allow for forward slippage, producing undue stress on the pars, resulting in a fracture” (Froese, 2001, para 3).

- **Type 2:** “Caused by the development of a stress fracture of the pars interarticularis (Figure 2.2 in appendix D)” (Froese, 2001, para 4).
• **Type 3:** “Commonly caused by instability between the joints produced by facet arthropathy (a disease of the joint). This variation usually occurs in the adult population” (Froese, 2001, para 5).

• **Type 4:** “Results from acute stresses (trauma) to the facet or pars (figure 2.2, appendix D) (Froese, 2001, para 6).

• **Type 5:** “Any bone disorder may weaken the facet mechanism producing pathologic (caused by a disease) spondylolisthesis” (Froese, 2001, para 7).

**Age of onset:**

“Acute isthmic spondylolysis often occurs during the first and second decades of life. Most cases occur before the patient reaches age 15 years. In rare cases, spondylolysis that stays for a while and then disappears may be seen in early adulthood. Younger patients are at higher risk than older patients for developing spondylolisthesis that does not go away” (Froese, 2001, para 18).

“Congenital/dysplastic spondylolisthesis has been documented in children as young as 3.5 months. More commonly, congenital spondylolisthesis goes undiagnosed until later in life after an individual has been ambulating for quite some time” (Froese, 2001, para 19).

“Degenerative spondylolisthesis occurs most commonly after the age of 40 years” (Froese, 2001, para 20).

**Who Gets Spondylolisthesis?**

“Approximately 5-6% of males and 2-3% of females have a spondylolisthesis. It becomes apparent more often in people who are involved with very physical activities such as weightlifting, gymnastics, or football. Males are more likely than females to develop symptoms
from the disorder, primarily due to their engaging in more physical activities. Although some children under the age of five may be pre-disposed towards having a spondylolisthesis, or may indeed already have an undetected spondylolisthesis, it is rare that such young children are diagnosed with spondylolisthesis. Spondylolisthesis becomes more common among 7-10 year olds. The increased physical activities of adolescence and adulthood, along with the wear-and-tear of daily life, result in spondylolisthesis being most common among adolescents and adults” (Rodts, 2003, para 4).

**Things to avoid:**

- Avoid extension exercises as these will increase the risk of re-injury or further injury. Extension exercises include those that involve the person bending backward. Examples include hanging sit ups, laying on the floor on your belly and pushing yourself up with head going backwards, and therapy ball activities where the person lays on their back with the head going backwards.

- Avoid performing squats with these individuals as this will increase the amount of pressure placed on the spine and may cause pain and possibly re-injury.

- Avoid cardio exercise on the upright bike, walking on the treadmill, and elliptical trainers.

- Avoid using improper body mechanics as this will put more strain and may re-injure the low back.

- Do not perform calf raises on the standing machine as this puts much pressure on the spine and causes increased pain and may injury the back further.

- Avoid the exercise if it causes pain or discomfort.
Things to do:

- The leg press is good to use versus squats.
- Hamstring strengthening is good because many people suffering from spondylolisthesis have weak hamstrings which contribute to their condition.
- Recumbent bike is good for these individuals as part of a cardio routine.
- A water program is great because it decreases the amount of stress put on the spine and allows for a cardio routine.
- Abdominal strengthening of any kind is good. Try to avoid using weights with abdominal training until the abdominal muscles have gotten stronger.
- Always perform activities, especially weight lifting, with a neutral spine and with proper lifting techniques (lifting techniques may be viewed at the beginning of this protocol).
- Always stretch before and after your exercise session, especially the hamstrings, low back and thighs, which are the tightest areas of these individuals' muscles.
- When lifting weights, always have the person start out with a low weight and increase the weight load as the person can tolerate. If too much weight is lifted the person may tire easily and they may not use proper form while lifting.

Things to consider:

Some people who suffer from spondylolisthesis may recover from the disorder and symptoms over a period of time while others may suffer from the disorder and symptoms for ever. Most patients may return to their normal routines of daily living, which may
include exercise programs, after they are without symptoms. A flexion based protocol is essential to regaining control over their disorder and back pain.

**General:**

- ✓ Respect pain that the person may have
- ✓ If you are not sure of the person’s condition consult with their physician for contraindications the person may have.
- ✓ Consult an Occupational or Physical Therapist for further exercises that may benefit the client if you are not sure what to do.
- ✓ Follow the lifting techniques located at the beginning of this protocol.
- ✓ Use ergonomic principles (located at the beginning of this protocol) to decrease re-injury.
- ✓ Many Pilates poses are good to perform as they strengthen the spine, stretch the hamstrings and thighs, along with strengthening the abdominals and the buttocks muscles. Any moves however that are extension type, meaning extension of the spine occurs, should be avoided.

**Resources:**


Unit IV: Proper Positioning
Unit IV: Proper Positioning

Objectives:
1. To learn how to use ergonomics when exercising and weightlifting and ways to apply ergonomics to exercise and weightlifting so the members can do it safely.
2. To learn the importance of proper positioning

Proper Positioning Using Ergonomics
Positioning of Joints
On every piece of weight lifting machines are joints. These joints are the red balls on the equipment. The weight machine joints should be lined up with each individual user’s joints. The following are guidelines for lining up the weight machines joints with the individual user’s joints (This may be viewed in appendix B at the end of the manual):

1. In order to ensure proper fit make sure that joints on the machine are lined up with the member’s joints.
   A. For example, on the bicep curl machine, ensure the seat is heightened or lowered so that the member’s feet are planted firmly on the ground and knees are at a ninety degree angle. Ensure that the members elbow joint is lined up with the movement joint on the machine. The movement joint on the machine is usually the red ball where the machine leg moves. This will decrease strain on the lower back as well as the shoulders and elbows.
   B. When using the leg extension machine the joint of the machine should match up to the person’s knee joint.

Adjusting Seats and Legs on Weight Lifting Equipment
(These may be viewed in appendix B of the manual)

1. Adjustable seats and legs, which can be moved to fit each member individually, will decrease the amount of strain on the low back and other parts of the body.
2. Adjusting the height of the seat and length of the legs on the machine can be done quickly. Adjusting the leg and seat height is performed as follows:

A. On the legs on the machine is a knob. Turn the knob to the left to loosen it and then either pull on the leg to make the leg longer, or push on it to make it shorter. The leg should be adjusted so the individual users ankles rest on the pad on the leg and the feet are dangling over the edge.

B. The height of the seat may be adjusted by reaching underneath the seat and finding the knob that pulls outward. Pull on the knob, being careful as the seats are spring loaded, and then adjust it so that the knee joints (for the leg machines) and shoulder or elbow joints (for the arm machines) are lined up with the red joints on the machine.

Adding Support to Weight Equipment

(Pictures may be viewed in appendix B at the end of the manual)

1. If the member is short and the back support on the seat can not be moved or fit to the person for appropriate middle body alignment, then a board may be placed behind the back to fill the gap and increase the amount of support to the back.

Creating a Neutral Spine

(An example of the neutral spine may be viewed in appendix B of the manual)

1. All joints must be in a neutral position. The neutral spine may be viewed as follows:

A. A healthy back has 3 natural front-to-back curves that give the spine an "S" shape.

B. While there is much natural difference from person to person, too much curve in the back ("swayback") or too little curve in the back("flat back") can result in
problems.

C. The right amount of curve is called the neutral position.

Instruction Needed for Various Weight Lifting Modes

(Pictures of different weight lifting equipment may be viewed in appendix C).

1) With weight machines, such as the white life fitness machines found at Lifetime Health and Fitness, less instruction needs to be provided to the user since machines run only in one plane of motion. One plane of motion means that the equipment only goes one way and that is up and down.

2) Free weights require more skill because the person must control their movements as well as the movement of the weight. The beginning lifter should use machines instead of free weights until they practice and learn the movements with the machines. Once technique has been mastered free weight technique may be more easily learned.

3) Plate loaded machines allow for the addition and subtraction of small increments of weight. Plates may range from 2.5 pounds to 100 pounds and have to be added to the machine before lifting. Plate loaded machines generally also run in one plane of motion allowing for decreased instruction in technique. However, some plate loaded machines are not good for all people; especially those with low back pain and injuries, and employees at fitness centers should know which ones not to use with this population group. Such equipment is the plate loaded squat machine, regular standing squats with weights, the magnum calf machine and the hip sled.
These should not be used because they may place pressure and stress on the spine and this will decrease the space between each vertebrae causing pain.

4) Selectorized machines allow the user to quickly change the amount of weight on a machine.

5) There is usually a plate already on this equipment along with holes for pins to be placed. The individual user of the equipment places the pin into the amount of weight they have decided to lift. Planes of motion with this equipment is usually one plane, however some equipment has become two plane directional. Two plane directional means that the equipment runs up and down and side to side. If equipment runs in more than one plane, however, heightened instruction of proper technique must be taught to decrease injury.

6) Computerized equipment, such as the grey life fitness machines, are also used in gyms and allow for resistive training. This means that you set the resistance, either positively or negatively, into the computer on the weight machine and it provides the resistance you want. There is usually only one plane of movement with this type of weight lifting equipment, thus decreasing the amount of training needed to use the device.

**Cardio Equipment and Ergonomics:**

1) Most cardio equipment in fitness centers is designed to fit people from 5’6” to 5’10” tall. Modifications to equipment can not be made with most cardio equipment such as treadmills, elliptical trainers and stair climbers. These
equipment are however ergonomically sound for almost any member wanting to use them.

A. The stationary and recumbent bike seats are able to be adjusted to increase the fit of the person to the equipment.

B. The bike seat should be adjusted so when the person is pedaling and their legs are extended the knees are slightly bent to about five degrees.

Ergonomics with Free Weights

When using free weights, where proper body positioning is important in maintaining injury free joints, muscles and ligaments of the body, especially the low back, better training and education in lifting techniques must be used. The following is a list of principles to use when lifting weights (Weitz, 1997, para Appendix D):

1. Use the right muscles when lifting. “The first mistake in lifting is using the wrong muscles, the back muscles, instead of the leg and buttock muscles. You should always bend your knees when lifting heavy objects so you have a solid base for your spine. You should keep your middle section of the body upright when bending down and lifting something. A parallel trunk can put pressure on the lower back creating hundreds of extra pounds on the spine. This pressure can in time compromise a disc or sprain or strain a back muscle” (Medtronic Sofarmor Danek, 2001, para 3).

2. Keep the lower back in the neutral (excessively extended forward curve) position during the performance of most lifts, such as dead lifts, rows, and squats. To
maintain this position lightly pull in the abdominals and the glutes at the same time, making sure to avoid overly extending the spine. Pulling in the abdominals helps to raise pressure within the abdomen and hardens the spine (Weitz, 1997, para Appendix D).

3. A weight lifting belt may also be used to aid in maintaining a hardened spine while lifting (Weitz, 1997, para Appendix D).

4. Keep the knees at least slightly bent during all rowing and flexion exercises. Flexion exercises are exercises that use spinal flexion to complete the exercise, such as dead lifts and bent over rows. Rowing exercise are employed in the same manner as one would row a boat. (Weitz, 1997, para Appendix D).

5. Keep the trunk as upright as possible during squats (Weitz, 1997, para Appendix D).

6. “Another problem with lifting is exhaustion. The more you bend and lift, the more exhausted your muscles become. When muscles are exhausted they are more open to injury. Frequent breaks when lifting are preferable to help restore strength” (Medtronic Sofarmor Danek, 2001, para 7).

### Abdominal Exercises

(An example of abdominal machines may be viewed in appendix B)

1. Avoid hip flexor dominant abdominal exercises. This means exercises that involve using the muscles surrounding the hip. These exercises include straight leg raises, Roman chair leg raises, full sit ups, and most abdominal machines, especially those where the feet are hooked in. To decrease psoas muscle
involvement during crunches, point the foot downwards and pull down with the
heels to contract the hamstrings (Weitz, 1997, para Appendix D).

2. Avoid rotating exercises for the oblique muscles such as twists and rotary torso
machines, unless you are involved in sports in which rotation forces commonly
occur. Substitute diagonal and lateral movements instead (Weitz, 1997, para
Appendix D).

Stretching and the Muscles

1. Maintain adequate strength and endurance in the lumbar extensor muscles (Weitz,
1997, para Appendix D).

2. Keep the hamstrings, psoas muscle, and other hip muscles flexible through regular,
slow, static (without movement) stretching (Weitz, 1997, para Appendix D).

3. Avoid standing bent over stretches as these can over stretch the posterior ligaments
of the spine (Weitz, 1997, para Appendix D).

Body Positioning While Lifting

(Examples of these principles may be viewed in appendix B at the end of the manual).

1. “Another important guideline to follow is to limit twisting when lifting. This adds
more force to your back. If you must turn when lifting, pivot your feet instead of
twisting your back. In addition, always be sure of your footing. A sudden change
in footing or a trip can cause enormous amounts of added stress on the back”
(Medtronic Sofarmor Danek, 2001, para 6).
2. Don’t lift things when your feet are too close together. If your feet are closer than shoulder width you’ll have poor leverage, you’ll be unstable, and you’ll have a tendency to round your back (Medtronic Sofarmor Danek, 2001, para 7).

3. Don't lift with your knees and hips straight and your lower back rounded. This is the most common and stressful lifting move. Twisting the trunk during this bad move compounds the problem (Medtronic Sofarmor Danek, 2001, para 7).

4. Don't tense and arch the neck when lifting. This crams your neck joints together and causes pain especially if maintained for a long period of time (Medtronic Sofarmor Danek, 2001, para 7).

5. Do place your feet and knees at least shoulder width apart or front to back in a wide-step position. This will help you bend at the hips, keeping your back fairly straight and stress free (Medtronic Sofarmor Danek, 2001, para 7).

6. Do lean over or squat with the chest and buttocks sticking out. If you do this correctly, your back will be flat and your neck will balance in a relaxed neutral position (Medtronic Sofarmor Danek, 2001, para 7).

7. Don't lift things overhead with your neck and back arched, if possible (Medtronic Sofarmor Danek, 2001, para 7).

Guidelines When Carrying and Moving Weights

1. Don’t lift and/or carry an unbalanced load. Do balance your load on either side if possible, or switch sides so that both sides are equally stressed (Medtronic Sofarmor Danek, 2001, para 7).
2. Don’t lift and bend too much in a short period of time (Medtronic Sofarmor Danek, 2001, para 7).

3. Don’t lift objects that are too heavy for you (Medtronic Sofarmor Danek, 2001, para 7).

4. Do take weight off one or both arms if possible. When you squat down or push back up, use your hand or elbow as support on your thigh or any available structure. This takes some of the compression and strain off of the lower back (Medtronic Sofarmor Danek, 2001, para 7).

Resources:


Chapter Five
Summary

After completing the protocol, interviewing personal trainers and other staff at fitness centers and reviewing the literature, it was found that a need for a protocol of this magnitude is needed in fitness centers in Casper, Wyoming. The protocol provides an educational and informative manual for trainers in fitness centers to use with members. The protocol addresses the following areas: (1) ergonomics, (2) overview of the back, (3) a look at low back disorders, and (4) proper positioning.

A safe environment with well educated trainers is needed for members of fitness centers in order to decrease the risk and number of injuries that occur when exercising. The protocol can provide an opportunity to increase personal trainers knowledge about proper body positioning while lifting weights, along with education on ergonomic principles. The potential increase in personal trainer knowledge can contribute to an increase in the safety for members working out in local fitness centers.

All personal trainers should know how to treat clients who have back injuries. If the trainer does not, then they should refer the client to someone who does know in order to decrease the chance of injury that will, or may occur. It is recommended that fitness trainers receive adequate and appropriate training in the injury prevention and injury relapse process. General or front desk, employees should not have direct responsibility with creating a fitness plan for members, especially for those members with impairments such as low back injuries or pain. This is due to front desk workers lack of knowledge in anatomy, physiology, biomechanics and kinesiology. These employees, however, can be
involved in showing members how the equipment works and how it is operated as long as the managers at the facilities have guided them through training in how all of the equipment works and is operated.

A personal trainer at the fitness center should provide an in-service for new employees to help guide them in proper equipment use and positioning when using the facilities equipment. This is much the same as Occupational Therapists providing in-services for nursing assistants with safe methods to transfer residents while decreasing the risk of injury to themselves and the residents. The literature presented the common theme of the need for proper training with equipment use for the decrease in the risk of injury. If an employee is hired and not trained in how to operate the equipment safely, then the facility is legally and ethically responsible for any injuries that may occur among users of the equipment unless otherwise stated with a signature by the member.
Improper handling of weight. Do not hold weight away from the body. The person shown in the following diagrams has given consent for placement of the pictures in this appendix. Consent was also given by the fitness center manger to place pictures of the facility in this appendix.

Proper way of handling weight. Keep the weight as close to the body as possible when placing weight on weight equipment.
This is the incorrect way to place weights on the machine. Do not bend forward.

This is the correct form for putting weight onto equipment without bending forward. Squatting down takes pressure off the back.
Avoid twisting the trunk as shown here. The first picture demonstrates receiving the weight and the second picture shows the person twisting at the trunk to place the weight on the weight lifting equipment.
The top picture demonstrates the person getting the weight and the bottom one demonstrates the person rotating the feet to turn and put the weight on the equipment.
Appendix B: Proper Positioning
This Picture Shows How to Position the Machines Joints With The Users Joints. The Red Ball Should Line Up With The Members Knee Joint. This is The Correct Positioning.

This Picture Shows Incorrect Positioning of The Users Joint in Relation to the Joint on the equipment. Notice How the Users Knee Joint is Behind the Red Ball Joint.
This picture shows the user's elbow joint being lined up with the joint on the weight lifting machine (where the model's hand is pointing). This is the correct positioning when using the equipment.

This position of the elbow joint in relation to the joint on the machine is incorrect. Notice how the elbow joint is not lined up with the joint on the equipment.
This picture demonstrates how to adjust the legs on the weight lifting machines. The person’s right hand is on the black knob. Turning this knob allows for release of the leg for movement into the proper positioning. The left hand is on the leg and adjusts the leg out or in for proper fit to each individual member.

This picture demonstrates how to adjust the seat on the machine. The person’s right hand is on the knob under the seat and allows for adjustment of the seats positioning.
If the seat height cannot be adjusted to the user because they are too short, simply place a board behind the person to fill the gap between the seat and the individual user.

Avoid using abdominal machines and benches like this one as they put stress on the low back.
This picture demonstrates the neutral spine position. Notice how the person has the three normal curves of the back in the proper position.

This picture demonstrates an incorrect positioning of the spine. The person should not have an exaggerated forward curve in the spine when lifting and performing other exercises in the fitness center. The picture shown above is the correct positioning.
This picture demonstrates improper form when lifting and performing squats. Notice how the knees are straight and the upper part of the body is positioned too far forward. Also, the person’s legs are more than shoulder width apart.

This is the proper form while lifting and performing squats. Notice how the person’s knees are slightly bent and the back is as upright as possible. Also, the person’s legs are only shoulder width apart.
This is a front view of improper positioning when lifting weights and performing squats. The legs are too far apart, knees are straight and the upper body is bent too far forward.

This is the front view of proper positioning when lifting and performing squats. Notice how the legs are shoulder width apart, the knees are slightly bent and the back is as upright as possible.
Appendix C: Weight Lifting Equipment
This is an example of the weight lifting machines found in fitness centers.

This is an example of the computerized equipment found in fitness centers.
This is an example of plate loaded equipment found in fitness centers.

This is another example of plate loaded equipment, this is the plate loaded squat machine.
This is an example of the free weights (in the model's hands) and selectorized equipment (behind the model).

This is another example of free weights.
Appendix D: Spine Anatomy
This is a picture of the basic structure of the spine. The picture shows the different regions and terminology associated with the spine. From “Spine Anatomy”, Southern California Spine Institute, 2003, web page http://www.scoi.com/spinanat.htm. Copyright 2003 by Southern California Spine Institute.

Figure 3.1. This picture is a side view and back view of the spine. This picture shows the natural curves of the spine. Notice in the picture on the left how there are three curves. This is the neutral position of the spine. From “Vertebral Column”, by K. Bridwell, 2003, Spine Universe web page http://www.spineuniverse.com/displayarticle.php/article1286.html. Copyright 1999-2003 by SpineUniverse.com.

This is a picture of the lumbar vertebrae. The lumbar vertebrae are the largest of the vertebrae because they are the ones that hold the most load. From “Vertebral Column”, by K. Bridwell, 2003, Spine Universe web page http://www.spineuniverse.com/displayarticle.php/article1286.html. Copyright 1999-2003 by SpineUniverse.com.


Figure 2.2. This is a picture of the pars interarticularis. The green dots are the pars interarticularis. The red lines are the articular facets of the vertebrae. From, “Pars Interarticularis”, J. P. Gruen M.D, 2000. web page http://www.uscneurosurgery.com/glossary/p/pars.htm. Copyright 2000 by uscneurosurgery.com.

Figure 2.1. This is a picture of spondylolisthesis where one vertebra has slipped over another vertebra below it. From “Spondy Anatomy”, 2003 web page http://www.athleticadvisor.com/Injuries/Head_Back/spondy_anatomy.htm. Copyright 2000-2003 David Edell.