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Employing Physical Rehabilitation Techniques to Help the Obese Canine Patient

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Obesity is approaching epidemic status in the human population, so it is not surprising to learn that an estimated 34% of adult dogs in the United States are overweight. Obesity is described as a primary cause of osteoarthritis. This is not simply due to the excess load on joints, as we will see shortly. A large study showed that lifelong food restriction (25% less food than ad lib) in Labradors lead to a decreased prevalence of hip dysplasia, delayed onset of OA, and decreased severity of OA symptoms.

Clearly, diet management is a key to weight loss in the obese patient, and drugs are available to help patients lose weight. However, it is well recognized in human weight management that exercise is an essential component of successful weight loss and weight management programs. How can rehabilitation techniques help these patients? We need to first understand what veterinary rehabilitation is. From this, it will become clear that therapeutic exercise is very helpful, but that it must be applied skillfully, and that additional modalities will likely be needed to address postural and movement issues commonly found in the obese patient.

Let's begin by looking at the issues affecting the obese patient. New information regarding white adipose tissue (the primary tissue in abdominal fat, as compared to brown adipose tissue found in subcutaneous fat) shows that white fat cells secrete adipocytokines (pre-inflammatory cytokines), so obesity-associated inflammation extends beyond the adipose tissue.

Persistent low-grade inflammation and increased oxidative stress secondary to obesity may also play a role in many chronic diseases such as osteoarthritis. White adipose tissue ("WAT") is now recognized as a major pathogenic contributor to the development and exacerbation of many of the obesity-associated disorders. WAT is an active endocrine organ (Functional Adipose Tissue or FAT) whose functions are key to a number of normal physiological processes. When WAT is present in excess amounts in obese patients, the processes become disrupted.

As shown by a large study involving food management in Labradors, the best approach to life-long health is avoiding obesity. Client education should revolve around the notion that obesity is a disease that needs to be treated. In a recent presentation on nutrition for the rehabilitation practice, Dr. Julie Churchill (U. of Minnesota) explained the importance of taking a nutritional assessment of our patients, including obtaining a thorough food history. She encourages the enlistment of clients' support for initiating action by clearly demonstrating empathy for the client's relationship with their obese pet. The current maintenance food should be changed to a weight loss food. Calculating RER (resting energy requirement) for the ideal weight for this patient, (a simple estimate is to feed 40-

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50 Kcal/Kg of lean weight); then feeding 60-80% of the goal energy requirements which is what a weight loss food represents but without jeopardizing the intake of other nutrients like minerals and vitamins. The goal should be to achieve weight loss of 1-2% of body weight per week.

One caveat from Dr. Churchill's presentation is to avoid the temptation to simply reduce the volume of food currently offered, as you may decrease total energy intake, but at the loss of lean body mass through insufficient protein intake. On average, you should target for 1gm of protein per pound of body weight daily. Resources to assist us in finding balanced foods for our obese patients include the product guides from the various manufacturers; www.NSSVET.org has a diet manual; ACVN.org has a home made food formulation, and www.petobesityprevention.com has great information.

Pfizer's weight loss product, Slentrol (dirlotapide), is a microsomal triglyceride transfer protein (MTP) inhibitor. It works by preventing fat transfer to the blood, so the enterocyte fills with fat. This causes release of a hormone that signals fullness at the hypothalamus, leading to the sensation of satiety. The principal problem reported with Slentrol is a rebound weight gain after discontinuation of the drug.

Let's now look at how rehabilitation techniques can assist your efforts to obtain weight loss and weight management success in your patients:

What is veterinary rehabilitation?

Many people believe that veterinary rehabilitation consists of a series of therapeutic exercises, especially involving the Under Water Treadmill, which can be applied to our animal patients. The notion that this field would be easy to grasp, with intuitive reasoning, and little training, has lead many to attempt to add rehabilitation to their veterinary practices.

In reality, veterinary rehabilitation is the application of an all-new diagnostic algorithm to our patients. It focuses upon soft tissues rather than bone and joint. It involves special tests that allow for determination of specific tendinopathies and soft tissue abnormalities. The use of Objective Outcome Measures, evaluated with Goniometers and Gulick Girthometers provides clear evidence of the progress of the patient during and after rehabilitation therapies have been applied. The emphasis in rehabilitation therapy is on meeting goals that are *functional* for the patient.

The goals of rehabilitation include the restoration, maintenance and promotion of optimal function and quality of life as they relate to movement disorders. The majority of rehabilitation therapeutics involves *manual therapies* and problem solving rather than the use of "toys". Examples of *manual therapies* include joint mobilizations, focusing on arthrokinematics rather than osteokinematics, *stretches*, focusing upon flexibility and hypomobility, and *therapeutic exercises*, progressing from concentric to eccentric contractions.

Equipment utilized on a regular basis in veterinary rehabilitation includes physioballs, therapy bands, rocker/wobble boards, Cavaletti poles and land treadmills. Hydrotherapy equipment can include pools, resistance pools and underwater treadmills.

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Therapeutic exercise contributes to weight management in rehabilitation practice in a number of ways. Exercise Induced Hypoalgesia (EIH) is a recognized phenomenon, but the mechanism is unclear. The most studied mechanism is that of activation of the opioid system with β -endorphin release from the pituitary. It is also believed that exercise can activate large afferents, bringing the Gate Theory into play. In addition, exercise activates the corticospinal tract, causing decreased spinothalamic tract responsiveness in the dorsal horn, and presynaptic inhibition.

In chronic obese patients, the initial therapeutic exercise work will focus on stretching to return muscles to normal length, as obesity often leads to postural changes that create asymmetric muscle shortening. Exercise programs will then focus upon strengthening work to prevent muscle atrophy, thereby protecting, or decreasing the stress upon, the joint capsule, ligaments and cartilage. This helps to prevent cartilage damage with its associated release of inflammatory mediators and subsequent pain. Finally, in human medicine, there is clear evidence of the psychological benefit of exercise via distraction of the patient from stressful stimuli.

THERAPEUTIC EXERCISE

GOALS OF THERAPEUTIC EXERCISE

Exercise can bring great benefit to the rehabilitation patient. It can assist to increase range of motion, stability, endurance and strength. Exercise can also improve balance, motor control, proprioception, and flexibility. Rehabilitation therapists apply exercises to help to normalize muscle tone, reduce pain, promote functional independence, and to improve weight-bearing tolerance.

RANGE OF MOTION When applying exercises to increase range of motion, we must consider whether we are looking to improve AROM or PROM. Which joint are we treating? And in what direction are we hoping to gain range? Our goal when working on range of motion is to gain a functional range. It may not be feasible to reach a "normal" range of motion, depending upon the lesion(s) affecting the joint, so we want to focus upon a functional outcome. The therapist must also take into consideration which tissues around the joint are affecting range of motion: joint surfaces, articular cartilage, joint capsule, and/or ligaments.

Range of motion exercises can be applied actively or passively. In the *active* ROM exercise, the patient is encouraged to perform exercises that cause the joint to assume the desired range. An example of this is the post-operative elbow fracture patient who does not want to extend the elbow. In an active ROM exercise, the patient can be lifted onto a physioball, with the forelimbs draped over the front of the ball. As the ball is gently rocked forward, the dog will extend the forelimbs to protect himself from falling on his nose, thus extending the elbow. A passive ROM exercise is one in which the therapist creates the motion, such as gentle flexion and extension of the stifle in a post-operative ACL patient. To assess the success of ROM exercises, a Goniometer is used pre and post therapy.

FLEXIBILITY

There is an important distinction between range of motion and flexibility. Where ROM

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refers to joint osteokinematics, flexibility refers to muscle and tendon elasticity. Often, flexibility issues appear in two-joint muscles rather than one-joint muscles. Once the affected muscle has been determined, therapeutic exercise that focuses upon stretching can be initiated. In the ambulatory patient, some form of warm up is recommended before initiating any stretching work. In the non-ambulatory patient, e-stim or therapeutic ultrasound may be used for this warm up.

Stretches can be done actively or passively. An active stretch is initiated by the patient. One of the most common forms of active stretching techniques involves the use to cookies to encourage the patient to reach into positions that will stretch the affected muscle. Examples include supporting the dog while holding a cookie near one hip. The dog will stretch the contra lateral epaxial muscles in an effort to reach the cookie. Active stretches can also be accomplished through active exercise, such as walking through weave poles or around cones set in a tight pattern.

Passive stretches are done by the therapist. The patient must be relaxed and willing to accept this stretching work. This work is generally well accepted by the patient once they gain confidence in the therapist. An example of a passive stretch is the therapist advancing the forelimb to stretch the Latissimus dorsi and Teres major muscles.

ENDURANCE

For the very debilitated patient, early endurance work may involve little more than assisted standing. When muscle is immobilized for a length of time, the first fibers that are lost are the slow twitch fibers. These are the most common fibers in our muscles of posture or gravity- resistance. The patient recovering from a period of recumbency will have very little endurance due to this lack of slow twitch fibers. Early rehabilitation will focus upon these postural muscles rather than on the cardiovascular system. The therapist will monitor heart rate and respiratory rate for evidence of fatigue. Exercise designed to improve endurance in an athlete *is* focused upon the cardiovascular system. As with any cardio program, the patient will gain increased duration of effort as well as increased speed and strength. As the program progresses, the therapist will monitor heart rate, respiratory rate, and the rate at which each recovers after a maximal effort. Endurance training can be done on the ground, on a treadmill, or using hydrotherapy equipment.

To augment the effects of an exercise program, resistance can be added to the routine. This can be done using weighted vests, sleds or resistance bands, hill work, and water. This is an area where the underwater treadmill has gained great interest.

STRENGTH

The emphasis in strength training will be upon resistance. In our debilitated patient, strength training may include little more than moving from down to sit and sit to stand. Here, gravity is the only resistance needed. External resistance will be added as the patient progresses. There are many weight options in veterinary rehabilitation. If the focus is upon strengthening a single limb or set of muscles (e.g.: the elbow flexors), leg weights can be applied. These come as small Velcro bands with pockets, into which can be placed packets of weights in one to 4 ounce increments. Care must be taken to avoid any shearing affects upon the joints above the weighted band.

An area of strength training which has received a great deal of interest lately is core strengthening. This is done to help prevent thoracolumbar and lumbosacral injuries, especially in the canine athlete and in chondrodystrophic breeds. Core strengthening

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exercises include begging, 2-leg standing, and stability work done on a physio ball or wobble board. Care must be taken to avoid excessive work in this area, as fatigue occurs rapidly.

PROPRIOCEPTION

Many rehabilitation patients struggle with body awareness, especially with proprioception. This is defined as the awareness of body position. Therapeutic exercise can address this problem through many avenues. In the debilitated patient, proprioception training might be as simple as assisted standing, which progresses to standing with the addition of gentle perturbations by the therapist. When the patient is able to resist these movements without losing balance, more challenges can be added, such as performing these exercises on rocker boards, wobble boards, and other unstable surfaces.

A rocker board is a platform with a rounded rail on the underside. When the patient is asked to stand on the rocker board, it will tend to rock from side to side. They must work to resist this movement. Once they are capable of maintaining their balance on a rocker board, it can be replaced with a wobble board. This platform has a hemisphere on the underside, so it can rock in any direction. The size of this hemisphere can be increased to increase the challenge. The rehabilitation therapist can use these boards for many different problems. Asking the neurological patient to stand on the board with their front feet, while 'balancing' on their rear paws encourages early strengthening of the rear limbs and epaxial muscles. In the post operative elbow fracture patient, placing the rear limbs on the rocker board with the front limb(s) on the ground creates a setting in which the patient elects to extend the elbow to regain some balance.

More active proprioception exercises include walking through a 'pile' of PVC rails or over Cavaletti rails, set at irregular heights and distances. Walking the dog on an air mattress can improve proprioception as well. The tighter the air mattress is filled, the easier it is for the patient. As the dog gains skill on this surface, gentle perturbations can be added, either to the patient or to the mattress surface. Balance blocks are another proprioception tool. The dog can be placed upon these blocks and asked to stand. The blocks can then be slid apart, forward, together, etc. requiring the dog to reestablish its balance.

DESIGN OF THE THERAPEUTIC EXERCISE PROGRAM

A physiotherapist evaluates the patient, identifies the structure(s) involved, and identifies the stage of recovery of the tissue. From this evaluation, goals are set, and a therapeutic exercise program is designed to address these goals. With each visit, the patient is evaluated to assess whether the goals are being met. If any goals are not met, the program is adjusted to correct for deficits. The rehabilitation therapist must be able to recognize when the patient is ready to progress from early exercises to those that are more challenging.

An example of progressing therapeutic exercise is the weakly ambulatory dog who is recovering from an FCE. In early therapy, the therapist will work with simple concentric exercises such as an assisted sit to stand exercise. In this example, the dog will be supported so that it is sitting on a physio ball. With assistance, the dog is encouraged to rise to a stand. This will require a concentric contraction of the quadriceps mechanism, through just the last half of the range of motion. As the patient gains strength, the exercise will be progressed to rising from deeper and deeper sitting positions. Once the dog is strong enough to rise from a full sit, the next exercise will be to progress to

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eccentric contractions. In this example, the dog will be asked to go from standing to sitting, slowly. This requires a much more controlled contraction of the same muscle group which has gained sufficient strength to resist gravity, but which now must lengthen during the contraction.

During this dog's therapy session, he will also be challenged with proprioception exercises, starting with simple standing with one to two paws on a rocker board. As this becomes simple for the patient, challenges are added, until the rocker can be changed to a wobble board. When our patient has progressed beyond the wobble board, work will progress on endurance exercises, encouraging the patient to spend longer and longer periods in standing and ambulation. If there is asymmetry in the strength on one side, weights may be added to challenge the weaker side. The final stage of recovery will focus upon strength training. Here our FCE patient will begin with stair or hill climbing. Resistance bands, weighted vests or individual leg weights will be added as indicated to correct for asymmetry in strength.

There are many physical therapy techniques available to the veterinary rehabilitation therapist, each of which can add tremendous benefit to the patient. This is not to say that by simply purchasing these modalities and applying them to your patients you can expect great results. Excellent manual skills, meticulous diagnostic techniques, and creative problem solving are all essential before adding a modality. The benefits of this combination approach, applied with the correct medical pain management and weight management can bring great results to your post-operative patients, geriatric osteoarthritis patients, and elite athletes. To offer our veterinary patients the optimal care, we should work together with pain management practitioners and physical therapists to develop a truly balanced weight management plan for each patient.

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