Canine Myofunctional Therapy is a valuable discipline as it promotes proper muscle function and benefits the general health of the canine patient. Canine Myofunctional Therapy or CMT is the application of carefully selected massage techniques to address deviations in the dog's musculature and maintain muscle health. Healthy, functioning muscles are critical to the dog's wellbeing as they facilitate movement and perform involuntary functions such as circulation, respiration and digestion. When the muscles responsible for movement are impaired the dog's movement is likely to be restricted and they may experience discomfort. CMT facilitates muscle healing and restores the dog's range of movement. In so doing, it benefits the dog's overall health, particularly by stimulating the circulatory system and positively affecting other body systems.

Canine Myofunctional Therapy (CMT) is defined as the "application of a range of massage techniques to the muscles and soft and connective tissues, to promote or restore biomechanical functioning and range of movement". (Small Animal and Equine Naturopathic Association 2014) It involves the practitioner observing and palpating the dog to identify muscular deviations. When observing a dog in movement and stationary, the practitioner seeks to identify abnormalities in muscle tone, symmetry, weight bearing tendencies, tail and head carriage, joint angles, and fluency of movement. (Millis et al 2004) Palpation or "hands on" examination also seeks to identify asymmetry in muscle tone and areas of sensitivity. The practitioner evaluates the findings from their observations and hands on examination, formulates an appropriate treatment and applies massage techniques to address the deviations identified. Following the treatment, the practitioner analyses the results and recommends an appropriate course of action.

Maintaining optimum muscle health is integral to the dog's overall health due to the range of functions muscles perform. Muscles provide force for functions including locomotion, posture, respiration, circulation, and digestion (including excretory functions). They respond to the dog's emotional state by facilitating facial expressions, wagging the tail, barking, and raising the hair. Muscles also regulate the dog's body temperature. (Evans & de Lahunta 2013)

There are three types of muscles responsible for performing the above functions. They are: cardiac, smooth and skeletal. Cardiac muscle refers to the heart. Smooth muscles perform involuntary functions. They are found in hollow organs and blood vessels. They are also associated with glands, the spleen, eyeballs and hair follicles. (Evans & de Lahunta 2013) The third type of muscle is skeletal muscle which has two important functions. Firstly, skeletal muscles provide the force for locomotion by moving the skeleton to create movement and maintain the dog's balance and posture. Secondly, they support the skeleton. (Oxford

Concise Colour Science Dictionary 1997, Robertson 2010) Skeletal muscles are the main focus of CMT.

When skeletal muscles are injured, the dog will experience discomfort (or pain) and their ability to move freely will be affected. Muscles injure in any number of ways including overuse, sudden forceful contractions, forced extension or flexion, strength imbalances or inadequate preparation. (Edge-Hughes 2007) Muscle injury frequently occurs at the junction of the muscle and tendon due to the composition of these attachments. Muscles are attached to joints, bone, cartilage or other tissue via tendons or aponeuroses (flat, sheet like attachment). (Evans & de Lahunta 2013) These attachments comprise dense connective tissue with high tensile strength but limited elasticity compared with the muscle belly: the main power base for muscle contraction. (Hourdebaight 2004) When a muscle is injured and unable to contract to its maximum capacity, it stresses the attachments which may result in injury. Multi-joint muscles that cross two or more joints are also at risk of strain or injury because they are stretched in movement at more than one joint. (Edge-Hughes 2007)

A muscle's response to injury or stress is to perform a sustained contraction of the affected muscle fibres. (Mori et al 2004, Hourdebaight 2004) When muscle fibres remain contracted, it can result in inflammation, poor muscle performance, restricted movement, and development of compensatory issues. When muscles fibres remain contracted due to injury, the body's inflammation response is triggered, resulting in pain, swelling, and impaired mobility. (Hourdebaight 2004, Mori et al 2004) In this contracted state, blood flow to the affected muscle fibres is restricted so there is insufficient delivery of oxygen and inadequate removal of metabolic waste products to enable muscle performance. (Mori et al 2004) When muscle performance is compromised, the muscle is at greater risk of further injury as the uninjured muscle fibres bear the full force of the muscle's load. Injured muscles may also affect joint mobility. The contracted muscle fibres draw the bones in joints closer together and restrict the extent of joint extension and flexion. Finally, compensatory issues may arise from muscle injury as the dog adjusts their movement to compensate for the injured muscle. (Robertson 2010)

CMT facilitates healing injured muscles in particular it has been shown to positively affect range of movement (ROM). ROM is the degree to which the dog is able to extend and flex their limbs. It is influenced by the dog's conformation and the integrity of the soft tissues supporting the limbs. (Robertson 2010) As injured muscle fibres remain contracted, they reduce the range of joint motion through the dog postural guarding, avoiding painful positions, and exercising less. (MacFarlane et al 2014) CMT increases ROM by lengthening and

separating affected muscle fibres, promoting synovial fluid production and improving the lubrication of the joint. (MacFarlane et al 2014) This eases functional stress on the joint, influences the dog's perception of pain and improves the ROM. (Robertson 2010, Matthews et al 2014, Goats 1994)

In a study of horses, massage was shown to positively influence ROM. The study measured the horses' stride length and frequency before and after massage. Following treatment, the study found an increase in stride length and decrease in stride frequency which indicates the horses were able to cover more distance in each stride following massage. (Wilson 2002) In this study, massage appears to have facilitated an increase in the extension and flexion of the horses' joints to enable increased stride length.

CMT improves ROM by affecting the quality of the muscle tissue. In the study of horses mentioned above, an increase in the diameter of muscle tissue in the muscle belly and tendon junction was observed, following the application of several massage techniques. (Wilson 2002) The study showed an average increase in muscle tissue of 14% following massage, as measured by ultrasound. (Wilson 2002) This increase is attributed to changes in the fluid status of the muscle and the length and position of muscle fibres. (Wilson 2002) Another study, using rabbits, supports this finding by concluding that following the application of massage-like techniques the amount of damaged muscle fibres was reduced and the overall integrity of the muscle improved. (Haas et al 2012)

Improvements in muscle tissue quality and range of movement may be attributed to the mechanical nature of massage techniques. The pressure of massage strokes stretches and pulls muscles fibres in various directions and mobilises the connective tissue. (Millis et al 2004, Matthews et al 2014, Weerapong et al 2005) This action separates and elongates muscle fibres and releases adhesions. (Millis et al 2004, Wilson 2002, Weerapong et al 2005) In the case of muscle tears, massage plays two roles. Firstly, it assists healing through fibroblast function and recruitment. (Matthews et al 2014, Waters-Banker 2013) Secondly, it assists in reducing the formation of scar tissue by disrupting the formation of collagen fibres. (Millis et al 2004, Hourdebaight 2004, Goats 1994, Edge-Hughes 2007) In so doing, it facilitates the muscle to remodel along the lines of normal stresses. (Millis et al 2004, Hourdebaight 2004)

While the practice of CMT focusses on promoting proper muscle function, it also provides several other general health benefits. In particular, it stimulates the circulatory system which aids muscle performance but also benefits for the dog's overall wellbeing. The body's circulatory system comprises two parts: arterial and venous. The arterial part of the system

relies on the pumping action of the heart to circulate oxygenated, nutrient rich blood throughout the body's tissues via arteries, arterioles (small arteries) and capillaries. (Hourdebaight 2004) Providing fresh blood to the tissues is critical to the dog's health as it provides the body with many elements required to function. Blood contains red blood cells which carry oxygen, white blood cells which fight infection, nutrients, and plasma in which cells bathe. (Hourdebaight 2004) Providing blood to the body's tissues is required to remove metabolic waste, distribute endocrine secretions, equalise the water content in the body's tissues, regulate body temperature, defend the body against disease, and for blood clotting. (Hourdebaight 2004, Mori et al 2004) The second component of the circulatory system is the venous. Unlike the arterial part of the circulatory system that uses the heart's pumping action to move blood, the venous part of the system relies on the movement of the body's large locomotion muscles. (Hourdebaight 2004) The venous component carries waste back to the liver, kidney and lungs in veins where it can be expelled in its various forms. (Hourdebaight 2004, Robertson 2010) Excess waste fluids in the tissues that are not absorbed into the venous system via the veins enter the lymphatic capillaries as lymph: clear, colourless fluid. (Evans & de Lahunta 2013, Hourdebaight 2004) The lymphatic system relies on the venous part of the circulatory system to push the fluid to the heart. (Hourdebaight 2004, Robertson 2010)

CMT stimulates the body's circulatory system by applying mechanical pressure to the body's tissues. A study comparing effleurage (massage technique) with the application of shortwave diathermy and ultrasound showed that massage increased the blood flow while the other techniques had little effect. (Goats 1994) Massage achieves this effect by creating fluctuations in pressure in blood and lymph vessels between different parts of the body. (Millis and Levine 2004, Goats 1994) As pressure is applied to blood or lymph vessels in one area of the body, differences in pressure between other body areas is created. Fluid (blood and lymph) begins to move between areas of high and low pressure. A "flushing" effect occurs as de-oxygenated blood and lymph are pushed out of an area and oxygenated, nutrient rich arterial blood replaces it. (Millis et al 2004, Matthews et al 2014, Edge-Hughes 2007, Robertson 2010)

By stimulating the circulatory system and improving venous return, CMT has been shown to also benefit the body's lymphatic system. Several studies have shown that lymphatic drainage is the greatest after massage compared to other techniques such as passive movement or electrical muscle stimulation. (Goats 1994) Millis et al (2004) state that massage has been shown to increase lymph flow rate by 22 fold. (Millis et al 2004) Draining contaminated lymph fluid from the body is vital to maintain good health. When the lymphatic system cannot drain properly, due to blockages in lymph vessels, lymph fluid may accumulate resulting in a swelling or lymphedema. (Evans & de Lahunta 2013) In patients with long

standing lymphedemas, high pressure massage was shown to assist in damaging the lymphedemas by breaking down blockages and allowing fluids to escape. (Eliska & Eliskova 1995)

While CMT improves the function of the circulatory and lymphatic systems, it also affects the nervous system to improve muscle tone and increase ROM. The dog's nervous system comprises two components: central nervous system (CNS) and peripheral nervous system (PNS). The CNS comprises the brain and spinal cord while the PNS consists of the cranial and spinal nerves that carry information from the body parts to the CNS. (Hourdebaight 2004, Evans & de Lahunta 2013) There are numerous sensory receptors associated with muscles including muscle spindles and Golgi apparatus. (Hourdebaight 2004, Evans & de Lahunta 2013) The role of muscle spindles is to protect the muscle from overstretching by detecting length and the velocity at which a muscle is being stretched. If overstretch appears imminent, the muscle spindle initiates motor neurons to contract the muscle. (Evans & de Lahunta 2013, Oxford Concise Colour Science Dictionary 1997, Hourdebaight 2004) The Golgi apparatus nerve endings provide feedback to the brain as to the location of the muscle, referred to as proprioception. (Hourdebaight 2004) These sensory nerves are susceptible to pressure such as that applied through sustained contraction caused by injury. When sensory nerves are impeded, impulses travelling along them to the CNS may be compromised. (Hourdebaight 2004) Injured nerve endings impact the tone of the surrounding muscle fibres. The muscle may atrophy because motor nerve impulses from the CNS are unable to reach the affected body part to engage the muscle fibres. (Hourdebaight 2004) CMT affects the quality of muscle tissue to reduce muscle tension and ease the pressure on the sensory receptors in the muscle thus allowing impulses from the CNS to reach the body part. This may prevent the muscle losing tone and contractile strength. (Goats 1994) Additionally, passive joint movement techniques may stimulate the neural pathways around the muscle or joint and reset the way the body views the affected area and in so doing improve the dog's ROM. (Hourdebaight 2004)

In addition to influencing the PNS to improve muscle tone and ROM, CMT can also affect the dog's autonomic nervous system (ANS). The ANS controls vital bodily functions such as breathing, circulation and digestion. (Hourdebaight 2004) It comprises the sympathetic and parasympathetic divisions. (Hourdebaight 2004, Robertson 2010) The sympathetic division controls the dog's "flight or fight" reactions. CMT may stimulate the sympathetic division to mobilise the body's resources for action. (Hourdebaight 2004, Robertson 2010) This type of treatment is effective to prepare a dog for work or a sporting event. The parasympathetic division of the ANS is responsible for functions such as breathing, circulation, digestion and immune response. (Hourdebaight 2004) CMT may also be applied to calm and relax this

division of the ANS such as in the case of post event treatments. (Hourdebaight 2004, Robertson 2010, Matthews et al 2014)

While the effects of CMT on the nervous and circulatory systems have been discussed, the benefits to other body systems should also be acknowledged. CMT supports the digestive system by stimulating peristalsis to aid digestion and assist impactions. By improving circulation, CMT aids the delivery of hormones to organs through the endocrine system. Finally, CMT benefits the integumentary system (skin, hair and nails) by removing blockages in the sebaceous glands and maintaining good skin health. Good skin health in turn supports proper muscle function as dehydrated skin restricts the performance of the underlying muscles. (Kainer & McCracken 2003)

Although CMT is a very safe practice, it has powerful effects on the body's systems and must therefore be applied with caution. For some dogs, CMT may be contraindicated due to a range of health conditions. Generally, massage should not be performed during the acute stage of an injury such as a fracture, burn, muscle tear, haematoma or post operatively. The acute phase is the first seven to ten (10) days from the time the injury occurred. (Hourdebaight 2004) During this stage, massage could compromise the body's natural healing process by moving white blood cells away from the site of injury and increasing blood flow inappropriately. (Robertson 2010)

Other health conditions for which CMT is contraindicated are infection and malignancies. Infections may be viral, bacterial, fungal or parasitic. (Hourdebaight 2004) Massage could interfere with the body's natural healing process by increasing blood flow and spreading the condition throughout the body. (Robertson 2010, Hourdebaight 2004)

Some conditions may cause the practitioner to seek approval from the dog's veterinarian before proceeding with a treatment. These conditions include the dog taking blood thinning or pain medication or the dog being diagnosed with a heart condition. As massage reduces the viscosity of the blood (Millis et al 2004, Goats 1994) and stimulates the circulatory system, advice and clearance from a veterinarian is advisable for dogs with heart conditions or taking these types of medications.

Contraindications are important to note due to CMT's effects on the dog's entire body. While principally concerned with promoting proper muscle function by lubricating and separating muscle fibres, CMT also benefits the dog in many other ways. It stimulates the circulatory system which in turn assists lymphatic drainage and distributes nutrients, endocrine secretions, oxygen, and white blood cells. CMT also stimulates or relaxes the nervous system,

supports the digestive system and improves skin health. With the potential to facilitate such wide reaching health benefits, CMT can truly be considered a valuable discipline within the suite of holistic approaches to canine health.

Bibliography

Edge-Hughes, Laurie (2007) “Hip and sacroiliac disease: selected disorders and their management with physical therapy”, Clinical Techniques in Small Animal Practice 22 p 183 – 194

Eliska, O & Eliskova, M (1995) “Are peripheral lymphatics damaged by high pressure massage?” Lymphology 28 p21-30

Evans, Howard and de Lahunta, Alexander (2013), *Miller’s anatomy of the dog* 4th edition, Elsevier Saunders, St Louis, Missouri, USA

Goats, G,C. (1994) “Massage-the scientific basis of an ancient art: Part 2. Physiological and therapeutic effects”, British Journal of Sports Medicine 28 (3) p153 – 156

Haas, C, Butterfield, T.A, Zhao, Y, Zhang, X, Jarjoura, D & Best, T.M (2012) “Dose-dependency of massage-like compressive loading on recovery of active muscle properties following eccentric exercise: rabbit study with clinical relevance” British Journal of Sports Medicine, Published online June 26 2012

Hourdebaight, Jean-Pierre (2004), *Canine Massage: A complete reference manual* 2nd edition, Dogwise Publishing, Wenatchee WA, USA

MacFarlane, P.D, Tute, S.A & Alderson, B (2014) “Therapeutic options for the treatment of chronic pain in dogs”, Journal of Small Animal Practice (55) p127 - 134

Matthews, K, Kronen, P.W, Lascelles,D, Nolan, A, Robertson,S, Steagall, P, Wright, B & Yamashita, K (2014) “Guidelines for recognition, assessment and treatment of pain” Journal of Small Animal Practice, Vol, 55 p10 – 68

Millis, D.L, Levine, D & Taylor R.A (ed) (2004) *Canine Rehabilitation and Physical Therapy*, Elsevier Inc, Missouri USA

Mori, H, Ohsawa, H, Tanaka, H, Taniwaki, T, Leisman, G & Nishijo,K (2004) “Effect of massage on blood flow and muscle fatigue following isometric lumbar exercise”, Medical Science Monitor, 10 (5) p173 - 178

Oxford Concise Colour Science Dictionary (1997) Oxford University Press, Oxford UK

Robertson, Julia 2010, *The complete dog massage manual*, Veloce Publishing Limited, Dorset UK

Small Animal and Equine Naturopathic Association (2014) www.saena.com.au (3rd October 2014)

Waters-Banker, Christine (2013) “Immunomodulatory effects of massage in skeletal muscle”, Theses and Dissertations – Rehabilitation Sciences, Paper 18

Weerapong, P, Hume, P.A & Kolt, G.S (2005) “The Mechanisms of Massage and Effects on Performance, Muscle Recovery and Injury Prevention” Sports Medicine 2005: 35 (3) p 235-256

Wilson, J (2002) “The effects of sports massage on athletic performance and general function”, Massage Therapy Journal, Summer, p90-10