INTEGRATIVE MEDICINE: THE EVIDENCE, ECONOMICS, & LOGISTICS OF AN EMERGING FIELD

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Veterinary clients are increasingly concerned about maximizing the health and wellness of their pets. An estimated $16 billion is spent annually on veterinary care for companion animals, and owners and veterinary insurers are pursuing therapies traditionally regarded as alternative and complementary. These therapies may also be increasingly recommended by the veterinary care team.

No comprehensive surveys have assessed the economic impact or prevalence of such therapies. However, a survey of veterinary students and colleges suggested that recent graduates frequently encounter questions from clients about these areas, and veterinary schools are increasingly responding with formal instruction in many of the relevant modalities.

Such trends in veterinary medicine mirror those extensively documented in human health care in which consumer demand has driven an increase in complementary or integrative medicine. The reasons are multifactorial but include distrust of aspects of conventional medical care, a view of natural or less invasive interventions as safer, and, in humans, a recognition of mind–body relationships.

WHAT’S IN A NAME?
The term integrative medicine was adopted by leading human clinical and research programs in recognition of the significant overlap between conventional specialties and other therapies. The National Institutes of Health defines integrative medicine as the incorporation of complementary (nonmainstream) approaches into “mainstream” health care and, as such, the list of potential therapies within the field is extensive.

Integrative medicine services in veterinary hospitals include various combinations of therapies (Table 1).

Other terms, such as holistic and alternative medicine, have been used to describe integrative therapies. However, holistic medicine suggests that conventional medical approaches do not account for the whole of a patient’s health, while alternative medicine implies that its therapies are outside, and separate, of conventional medicine. Therefore, neither term describes a system of medicine that incorporates efficacious aspects of conventional and complementary care.

INTEGRATIVE MEDICINE IN PRACTICE
Human patients have increasingly used integrative medical approaches in the past 2 decades, and it is theorized that these patients may also pursue integrative approaches for their pets.

In humans, the use of integrative therapies has particularly increased in certain patient populations: nearly 50% of human oncology patients use complementary therapies as part of their treatment protocols, and a veterinary study found a similar prevalence in pets nearly a decade ago. Increased research is necessary to better define the demand and current utilization of such therapies in veterinary medicine.

TABLE 1.
Complementary Therapies Commonly Integrated in Veterinary Medicine

Acupuncture
Nutrition, nutraceuticals, and herbal medicine
Laser therapy
Rehabilitation and sports medicine
Regenerative medicine (ie, stem cell or platelet therapy)
Hyperbaric oxygen
Homeopathy
Therapeutic massage
Veterinary spinal manipulation

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A recent small survey examined the benefits of offering acupuncture in small animal practices. Practices that offered acupuncture indicated that:

- A mean of 14% of appointments were for this service
- About ⅓ of their acupuncture clients used the practice for routine care after initially visiting the practice for their first acupuncture appointment.

Both acupuncture and randomly selected primary care clients indicated that:

- They were more likely to use a veterinarian who offered acupuncture
- The mean pet expenditures of both types of clients were similar, refuting the idea that only those with increased discretionary income elect acupuncture treatment.

PREPARING YOUR PRACTICE

Many practices have effectively managed to incorporate integrative therapies, while others have struggled even after a significant investment of time and resources. Therefore, each practice must evaluate a number of variables before offering integrative therapies.

Acupuncture

Evidence. The increasing use of acupuncture in veterinary medicine remains controversial, primarily due to the inclusion of aspects of Traditional Chinese Medicine by some practitioners. A complex system of acupuncture meridians, originally designed for humans, has been transposed to dogs and cats. The complete system has not been evaluated, but there is documented evidence for clinically relevant physiologic responses to needle insertion at specific acupoints (eg, GV-20, PC-6, ST-36) (Figure 1).9-11

Research in a number of species suggests that electroacupuncture—the application of low level (mA) current to acupuncture needles—releases endogenous opioids that modulate pain (Figure 2, page 80).12 However, clinical studies in veterinary medicine have been mixed and more are needed.13-16

Training. While no certification is legally required to perform acupuncture as a veterinarian, there are three major training and certification programs in the United States:

FIGURE 1. An acupuncture needle has been placed in this Weimaraner at GV-20, a common acupuncture point that is associated with sedation.
PRACTICE BUILDING

• Chi Institute, tcvm.com
• International Veterinary Acupuncture Society, ivas.org
• Medical Acupuncture for Veterinarians, onehealthsim.org.

These certifications are issued by private organizations and are not regulated. Tuition costs for the training programs listed above range from approximately $6000 to $8500. The AVMA does not regulate acupuncture certifications as they do with specialty board certifications, such as surgery or internal medicine.

Staffing. Acupuncture can be offered without additional staffing. Acupuncture needles are generally left in situ for 15 to 30 minutes, during which time a practice may or may not have a staff member with the patient and client. Most practices reserve a room for clients to relax with their pets after needle placement by the veterinarian.

Patient & Client Population. In small animal practices, acupuncture is most commonly employed for osteoarthritis and intervertebral disk disease. Therefore, small animal practices with a large geriatric pet population will likely support an acupuncture caseload if the clinic staff and veterinarians are proactive in offering the service. Practices with a rehabilitation or pain management focus will also likely derive benefit. Acupuncture anecdotally appears most successful in practices with longer appointment times and clients residing in certain geographic locations (eg, urban areas, East and West coasts). Clients will often need to return at a routine interval for regularly scheduled follow-up treatments, and these visits may increase the client’s bond to the veterinarian.

Facilities & Equipment. Acupuncture requires little additional equipment. Acupuncture needles are sold in different sizes, with 32- to 34-gauge needles being most commonly used in small animals. Cost per treatment for acupuncture needles is estimated at $1, and electroacupuncture units are available for about $300. The total treatment cost to practices in Central Florida was estimated as $50.65 per visit, including amortized education and administrative costs, with a reported average client fee of $95.80.

Practices should be prepared to have a room occupied for 40 to 45 minutes. This may be disruptive if it exceeds the average appointment time or if examination rooms are limited. Additionally, many practices use more comfortable furniture and examination areas for acupuncture rooms given that both patient and client will be relaxing during needle administration.

Summary. Acupuncture provides adjunctive treatment for management of chronic musculoskeletal and neurologic abnormalities, with few significant costs apart from initial training. Local market demographics are likely to heavily influence success of acupuncture in any practice.

Nutrition & Nutraceuticals

The number of commercial manufacturers of pet foods and supplements is increasing, and owners frequently inquire about novel strategies for feeding, including frozen, raw, grain-free, organic, home prepared, and sustainable diets. Dietary supplements are administered by some owners and may include vitamins, minerals, antioxidants, essential fatty acids, food extracts, chondroprotectants, and herbal medications, among others.

Guidelines for nutritional assessment have been published, and nutrition is a cornerstone of wellness examinations and programs. Discussion of nutrition with the client reinforces the veterinarian as the expert in this field and prevents nutritional outsourcing to other entities. Such discussions are likely to strengthen the owner–veterinarian bond, which has positive implications for the practice.

Laser Therapy

Evidence. Several classes of therapeutic lasers for pain, inflammation, and wound healing are marketed to veterinary professionals. Laser stands for light amplification by stimulated emission of radiation. Light in the visible red and infrared spectra (600–1000 nm) exerts the biologic effects of photobiomodulation, which include:

1. Increased adenosine triphosphate (ATP) production through activity on mitochondrial cytochrome C oxidase
2. Induction of cellular antioxidant production due to a sublethal increase of free oxygen radicals
3. Vasodilation as a result of nitric oxide release from proteins.

The clinical effects on increased dermal healing are well established in other animal models and in humans. The effects on tendons and osteoarthritis are mixed or unclear. Few clinical trials in dogs or cats have been performed. A postoperative protocol for dogs after decompressive hemilaminectomy documented decreased time to ambulation. The benefits in other conditions are unclear. The potential side effects at high doses include thermal burns and cellular apoptosis, and the optimal doses for most conditions are not yet established.

Training. Laser manufacturers typically provide training to the purchasing veterinary practice. For example, the American Institute of Medical Laser Applications (aimla.org) provides additional training on laser theory, types, and protocols. Independent training may be provided by rehabilitation and sports medicine training programs and continuing education conferences.

Staffing. Veterinary technicians can be trained to provide laser therapy based on the attending veterinarian’s prescription. Knowledge of anatomy and laser principles is helpful.

Patient & Client Population. Therapeutic lasers are used most frequently for wound or incisional healing, osteoarthritis, soft tissue injury (tendon, ligament), and intervertebral disk disease. There is likely significant overlap with the patient population for which acupuncture and rehabilitation is suitable. Some practices use laser therapy on all cases postoperatively to increase their laser caseload and return on investment.

Facilities & Equipment. The cost of a laser is generally proportional to its power. Lower-powered lasers (class IIIb) may be purchased for around $5000, whereas those with a higher power (class IV) range upwards of $20,000. The power (W) describes the amount of energy (J) delivered over time (s). A higher-powered laser can deliver a dose of photonic energy in a shorter period of time, saving labor costs. The benefits of low-power versus high-power lasers are heavily debated. Practices will require a significant laser caseload to achieve an adequate return on investment with most class IV lasers.

Summary. Laser energy exerts potentially advantageous cellular effects. The precise dose needed in the treatment of veterinary patients to reach targeted cells remains unknown for most conditions, and only limited clinical trials are available. Practices should carefully evaluate their potential caseload before committing to an expensive laser.

Rehabilitation

Evidence. Canine rehabilitation has experienced significant growth in recent years. Rehabilitation protocols rely on a combination of physical exercises, hydrotherapy (Figures 4 and 5, page 82), therapeutic ultrasound, thermal modalities, laser, electrostimulation, and shockwave therapy. Many specialty centers have established rehabilitation practices to routinely assist in postsurgical recovery and reconditioning. The literature in this area has...
primarily focused on questions of basic mechanisms and responses, whereas controlled clinical data are comparatively sparse.

**Training.** Two training certifications are presently available for canine rehabilitation: one offered by the University of Tennessee Rehabilitation program (ccrp.utvetce.com) and another by the Canine Rehabilitation Institute (caninerhabinstitute.com). Cost of tuition ranges from $5000 to $6500. Certification is available for veterinarians, veterinary technicians, and physical therapists.

Similar to acupuncture training, certification is not legally required to incorporate rehabilitation modalities into a clinical practice. Specialist certification is regulated by the American College of Veterinary Sports Medicine and Rehabilitation (vsmr.org) and requires considerable practice experience or residency training.

**Staffing.** Rehabilitation is labor intensive and veterinarians will be unable to charge effectively for their time if they are performing the modalities themselves. As a result, a trained and dedicated technician is necessary in most practices. Two to three rehabilitation technicians are utilized for every evaluating veterinarian in many dedicated rehabilitation programs.

**Patient & Client Population.** Practices with a robust orthopedic surgery caseload and/or sports medicine patients are most likely to benefit. Rehabilitation can also be of value in geriatric and neurologic patients, but the caseload may be insufficient if reliant on this population alone. Most clients who invest in surgical repair of an injury, or who prefer to avoid surgery, appear willing to pay the comparatively low cost for rehabilitation. Many clients are receptive to a fee structure in which individual modalities are included in a package price rather than itemizing specific charges for each intervention, which also avoids any appearance that items are being oversold to increase clinic production.

**Facilities & Equipment.** The breadth of rehabilitation services offered is directly related to the initial costs. Many rehabilitation techniques require sufficient space, and an area of about 500 square feet is the suggested minimum if active exercises are performed. This space requirement can be a challenge for existing practices, most of which were not designed with rehabilitation in mind. Passive modalities can be provided with less space, but this may limit the type of cases that can be managed.

Equipment costs vary considerably based on the modalities offered. Table 2 provides a list of equipment and suggested applications.

**Summary.** Rehabilitation medicine incorporates many different therapies and can...
be tailored to the practice. However, dedicated technical staff will be required, and sufficient caseload is best achieved with an existing population of geriatric, performance, or postsurgical patients.

**Regenerative Medicine**

**Evidence.** A patient’s endogenous cells can be harvested, processed, and then employed to stimulate tissue repair and to reduce inflammation. The primary regenerative veterinary medical techniques are platelet therapy and stem cell therapy. The hemostatic effects of platelets are well known, but platelets also contribute to cellular signaling, immunity, and tissue regeneration. The latter is primarily mediated by a number of growth factors found in alpha granules (Table 3).25 Dogs have shown clinical response when treated with platelet products for osteoarthritis, postoperative cranial cruciate ligament rupture, and tendinopathy, although such studies are preliminary and often characterized by low study numbers and lack of a control group.26-28 Moreover, studies in other species have been mixed. Various platelet collection and processing systems are available and described in previous scientific studies (Figure 6, page 84).29

Autologous stem cells are typically processed from adipose tissue, obtained from surgical collection of falciform ligament or subcutaneous fat, and variably described as mesenchymal or adipose-derived stem cells. These cultured multipotent cells can then theoretically differentiate into adipocytes, chondrocytes, or osteoblasts.

Initial clinical studies in dogs with osteoarthritis demonstrate a modest and temporary reduction in clinical signs.30,31 Some authors suggest that any

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<tr>
<th>TABLE 2.</th>
<th><strong>Rehabilitative Equipment: Suggested Uses &amp; Costs</strong></th>
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<tbody>
<tr>
<td>EQUIPMENT</td>
<td>USE</td>
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<tr>
<td>Underwater treadmill and/or pool</td>
<td>Low-impact activity</td>
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<tr>
<td>Therapeutic ultrasound</td>
<td>Deep thermal stimulation, collagen remodeling</td>
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<tr>
<td>Therapeutic laser</td>
<td>Tissue healing</td>
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<tr>
<td>TENS/NMES unit</td>
<td>Electrostimulation</td>
</tr>
<tr>
<td>Shockwave therapy</td>
<td>Tissue remodeling</td>
</tr>
<tr>
<td>Exercise aids/equipment</td>
<td>Therapeutic exercises</td>
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NMES = neuromuscular electrical stimulation; TENS = transcutaneous electrical nerve stimulation

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<th>TABLE 3.</th>
<th><strong>Growth Factors in Platelet Alpha Granules</strong></th>
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<tr>
<td>GROWTH FACTOR</td>
<td>FUNCTIONS</td>
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| PDGF-BB (and other isoforms) | • Mitosis of fibroblasts and smooth muscle cells  
| | • Angiogenesis and connective tissue production  
| | • Influences expression and coordination of other growth factors |
| TGF-beta | • Extracellular matrix synthesis  
| | • Type 1 collagen production  
| | • Mesenchymal stem cell proliferation  
| | • Granulation tissue formation  
| | • Immunoregulation (local) |
| bFGF | • Angiogenesis  
| | • Proliferation of cells of mesodermal origin |
| VEGF | • Angiogenesis  
| | • Endothelial cell proliferation |
| EGF | • Angiogenesis  
| | • Mitosis of fibroblasts, osteoblasts, and epidermal cells  
| | • Keratinocyte locomotion and cutaneous collagen production |
| IGF-1 | • Cell proliferation and survival  
| | • Platelet signaling and activation  
| | • Myoblast proliferation |
| CTGF | • Fibrosis  
| | • Platelet adhesion  
| | • Angiogenesis  
| | • Developmental chondrogenesis |
underlying structural abnormalities should first be repaired for best results and that cartilage scaffolding is necessary for persistent cartilage repair.32

Training. Most platelet products can be processed in-house with minimal additional training beyond the information provided in product instructions. Autologous stem cells require surgical biopsy and processing by an outside laboratory. Intra-articular injection of both products requires knowledge of basic musculoskeletal anatomy.

Staffing. Additional staffing is not required.

Patient & Client Population. Practices with a geriatric, sports medicine, orthopedic surgery, or rehabilitation caseload have the best opportunity to use these techniques. The cost of platelet processing and injection to the client will be greater than $150, and the cost of stem cell injections is generally greater than $1000 per dose.

Facilities & Equipment. Platelet processing requires centrifugation equipment obtained from the manufacturer of the separation system. Stem cell processing is typically done off-site. The initial investment in equipment is low, so these therapies can be offered on an intermittent basis.

Summary. Regenerative medicine is a growing area within integrative therapeutics. Clients find the concept of promoting endogenous healing to be appealing, but treatments are more expensive than other interventions. Practices with other integrative modalities are best positioned to use these treatments given the overlap in indications for this and other techniques.

Hyperbaric Oxygen

Evidence. Hyperbaric oxygen chambers (Figures 7 and 8) have been extensively studied and utilized in human medicine, but two of the most common applications in human health—decompression sickness and carbon monoxide toxicity—are rarely encountered in veterinary patients. However, they are also approved in humans for treatment...
of extensive wounds and burns, radiation injury, refractory osteomyelitis, compartment syndrome, and severe anemia. Hyperbaric chambers are used clinically, but not approved, for spinal and head trauma and stroke.

Physiologic effects of hyperbaric oxygen are well documented and similar to laser therapy; the advantage of hyperbaric oxygen is its systemic, rather than localized, effect. Hyperbaric oxygen induces:

1. ATP production by providing additional oxygen for phosphorylation
2. Compensatory increase in intracellular antioxidant production due to sublethal doses of free oxygen radicals
3. Post-treatment vasodilation due to nitric oxide release.

Veterinary research studies are mixed regarding effects of hyperbaric oxygen. Experimental studies in cats demonstrated positive effects on wound healing of skin flaps but minimal effects on short-term fracture healing. A standardized treatment protocol for dogs was shown to be well-tolerated in a clinical rehabilitation center, and oxygen toxicity—characterized by intrasession seizures and reported in many species, including humans and dogs—was not observed. The most common conditions treated included intervertebral disk disease and extensive wounds, although efficacy was not reported.

**Training.** The manufacturers of chambers provide initial training. There are independent organizations that certify hyperbaric technicians for human medical practice. A certified hyperbaric technologist program for veterinary staff is now available from several continuing education providers (nbdhmt.org/chtv.asp).

Specific guidelines for safe chamber use must be rigidly followed because oxygen chambers can be the source of injury or death, as was the case when an equine unit exploded in a private rehabilitation center in Florida. Adverse events of this severity have not been reported with small animal chambers, but veterinarians should discuss safety and liability with the chamber manufacturer.

**Staffing.** Hyperbaric chamber sessions require constant monitoring and, therefore, a dedicated hyperbaric technician is required unless the chamber is installed in a central treatment area where observation will be constant.

**Patient & Client Population.** Hyperbaric oxygen sessions are generally reserved for severe injuries, and only those facilities with a large emergency caseload or specialty referral population are likely to support the costs and technical staff required. Hyperbaric chamber sessions are charged at an average rate of approximately $150 per hour in the Southeast United States and, therefore, practices that can support a hyperbaric chamber are likely to be those with a higher average transaction charge.

**Facilities & Equipment.** Used or new hyperbaric oxygen units manufactured for humans can be purchased for animal use, while veterinary-specific hyperbaric chambers are available from Veterinary Hyperbaric Oxygen (vhbo2.com) and Hyperbaric Veterinary Medicine (hvmed.com). Companies may provide lease options to reduce initial costs, but modification of an existing building is required to provide a true earth ground, an outside exhaust line, and dedicated oxygen input.

The outright purchase cost of a hyperbaric chamber is quite variable, and veterinary manufacturers either exclusively lease or do not provide exact costs publicly. Human hyperbaric chambers start at around $75,000 for a reconditioned unit that is about 10 years old. New units with advanced monitoring and/or safety features for human practice may cost more than $150,000.

**Summary.** Only several hyperbaric chambers were in use for small animals nearly a decade ago, but now dozens of chambers have been installed in large practices in the U.S. The hyperbaric veterinary field is expected to continue to grow, but practices should carefully evaluate whether there is adequate caseload to justify the operating and startup costs. Moreover, additional information is required to better refine the clinical benefits of hyperbaric oxygen.

**THE PRACTICE OF THE FUTURE**
Integrative medicine has experienced significant owner-driven growth. As a result, it is unlikely the profession will witness a reduction of these therapies in the future.

Clients are increasingly searching for comprehensive treatment protocols, and clinics that can provide the best combination of therapeutic modalities are likely to improve market share and patient care. Practices investing in one or more integrative modalities now are also likely to gain the experience necessary to adapt to future trends and implement the best evidence-based complementary approaches with conventional care.
In the future, and as additional research becomes available, many therapies considered “outside mainstream treatment” today will likely become standard treatment in the future and provide a critical component of veterinary care.

NMES = neuromuscular electrical stimulation;
TENS = transcutaneous electrical nerve stimulation;
VSM = veterinary spinal manipulation therapy

References