

## Laser Acupuncture: Healing with Light

Lasers, whose name in the singular represents the acronym “Light Amplification by Stimulated Emission of Radiation”, have become indispensable tools for a wide array of medical and surgical applications.<sup>1</sup> There is now evidence that low-power laser (LPL) treatment can also provide safe and cost-effective treatment for wound healing, neurologic recovery, and pain reduction.<sup>2 3</sup> Investigations into the benefits of LPL are taking place in a wide array of human medical fields, including sports medicine, dermatology, physical medicine/manual therapy, acupuncture, dermatology, neuroendocrinology, rehabilitation medicine, trauma medicine, surgery, and dentistry.<sup>4</sup> Similarly, instruments that deliver laser and light stimulation potential to impart healing for veterinary patients are receiving increasing recognition from veterinarians and lay practitioners.<sup>5</sup>

Scientists first recognized the bio-modulatory effects of low-energy laser irradiation in the 1960's;<sup>6</sup> later research demonstrated benefit for the treatment of postoperative pain and wound infections.<sup>7</sup> Also known as “soft” or “cold” lasers, LPLs comprise three main types: visible red helium-neon (HeNe) lasers (emitted wavelength of 633 nm), invisible infrared (IR) gallium-arsenide (GaAs) lasers (904 nm), and gallium-aluminum-arsenide (GaAlAs) lasers (830 nm). Biomodulatory capability may vary with the laser type and the wavelength it produces which, for healing, should be longer than 600 nanometers.<sup>8</sup> HeNe lasers may be better at treating wounds and skin ulcers,<sup>9</sup> whereas GaAs<sup>10</sup> and

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<sup>1</sup> The American Society for Laser Medicine and Surgery, Inc. website: <http://www.aslms.org/a/about/info.html> .

<sup>2</sup> Naeser, MA. Neurological rehabilitation: acupuncture and laser acupuncture to treat paralysis in stroke, other paralytic conditions, and pain in carpal tunnel syndrome. *J Alt Compl Medicine*. 1997;3:425-428.

<sup>3</sup> Muxeneder R. Soft laser in the conservative treatment of chronic skin lesions in the horse. *Der Praktische Tierarzt*. 1987;68:12-21.

<sup>4</sup> Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>5</sup> Pontinen, Op. cit.

<sup>6</sup> Laor Y et al. The pathology of laser irradiation of the skin and body wall of the mouse. *Am J Pathol*. 1965; 47:643. Cited in: Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>7</sup> Tsubulyak VN et al. Reflexotherapy for analgesia and treatment of infected wounds. *Scand J Acup Electrother*. 1988;3:137.

<sup>8</sup> Kana JS et al. Effect of low power density laser radiation on healing of open skin wounds in rats. *Arch Surg*. 1981; 116:293. Cited in: Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>9</sup> Mester E et al. The biomedical effect of laser application. *Lasers Surg Med*. 1985; 5:31. Cited in: Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

GaAIs<sup>11</sup> lasers may be more effective for analgesic effects in the deep and superficial tissues, respectively. Compared to high-power lasers that generate heat with a power density of 10 watts per square centimeter, low-power lasers (LPLs) are relatively “athermic” and deliver less than 1 watt per square centimeter.<sup>12</sup>

Acupuncturists first began experimenting with low-power lasers (LPLs) during the 1970s.<sup>13 14</sup> The touted applications of lasers are numerous: myofascial pain, poorly healing and infected wounds, decubitus ulcers, oral mucosal ulcers, burns, scar tissue, rheumatoid arthritis, reproductive problems, immunologic disorders, digestive irregularities, neurologic and concomitant pain problems, peripheral nerve and spinal cord injuries, soft tissue contusion, sprains, tendonitis, and partial muscle tears.<sup>15 16 17 18</sup> Due to the increasing popularity of laser and light therapy treatments for animals, veterinary clients are likely to present with questions regarding this equipment. Many companies that manufacture lasers and related light therapy devices (such as BioScan<sup>TM</sup>,<sup>19</sup> Light Force,<sup>20</sup> and Equilight<sup>21</sup>) market directly to consumers.<sup>22</sup> As such, it behooves veterinarians

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<sup>10</sup> Schwanitz R. The position of acupuncture and the importance of its methods in sportsmedicine. Abstracts, Third World Congress of Scientific Acupuncture, ICMART '88, Prague. Cited in Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>11</sup> Oshiro T and Galderhead RG. *Low level laser therapy: a practical introduction*. Wiley: Chichester, England, 1988. Cited in: Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>12</sup> Baldry P. Chapter 12, “Laser Therapy” in *Medical Acupuncture: A Western Scientific Approach*. Filshie J and White A (eds.) Edinburgh: Churchill Livingstone, 1998, pp. 193-201.

<sup>13</sup> Bischko J. Use of the laser beam in acupuncture. *Acupuncture and Electrotherapeutics Research*. 1980; 5:29-30. Cited in: Baldry P. Chapter 12, “Laser Therapy” in *Medical Acupuncture: A Western Scientific Approach*. Filshie J and White A (eds.) Edinburgh: Churchill Livingstone, 1998, pp. 193-201.

<sup>14</sup> Yu C et al. Effect of laser irradiation on ST-36 on pain threshold in rabbit. *Proceedings of the National Agricultural Scientific Research Conference*. Beijing:China Agriculture Press. 1978; pp. 290-291. Cited in Wynn SG et al. Chapter 5, “Global Acupuncture Research: Previously Untranslated Studies.” In *Veterinary Acupuncture, 2<sup>nd</sup> Edition*. Schoen AM (ed.). St. Louis: Mosby, Inc. 2001. Pp. 65-66.

<sup>15</sup> Pontinen, Op. cit.

<sup>16</sup> Muxeneder R. Soft laser in the conservative treatment of chronic skin lesions in the horse. *Der Praktische Tierarzt*. 1987;68:12-21.

<sup>17</sup> Wynn SG et al. Chapter 5, “Global Acupuncture Research: Previously Untranslated Studies.” In *Veterinary Acupuncture, 2<sup>nd</sup> Edition*. Schoen AM (ed.). St. Louis: Mosby, Inc. 2001. Pp. 65-66.

<sup>18</sup> Oda Y et al. Effect of low level laser acupuncture on subclinical mastitis and reproductive disorders in dairy cattle. *Laser Ther*. 1994;6:157. Cited in Pöntinen PJ. Chapter 17, “Low-energy photon therapy” in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>19</sup> See [http://bioscanlight.com/vet\\_index.htm](http://bioscanlight.com/vet_index.htm) .

<sup>20</sup> Austin M. Device delight for folks in pain. *The Denver Post*. October 31, 2000. Pages 1C, 14C.

<sup>21</sup> See <http://www.therapy.com/Overview.htm> .

to become familiar with these products and related research evidence, in order to help their clients make appropriate and informed decisions about whether or not to seek this form of therapy for their animal.

How do they work? In contrast to needle acupuncture, in which input begins with the microtraumatic mechanical effects of the needle on local tissue,<sup>23</sup> laser acupuncture relies on the absorption and scattering of light within tissue.<sup>24 25</sup> Photons from the laser create a stimulating, biomodulatory effect. Physiologic changes include: increased phagocytosis, vasodilation, increased rate of regeneration of lymphatic and blood vessels, stimulation of enzyme activity at the wound edges, fibroblast stimulation, keratinocyte and fibrocyte proliferation, scar and keloid reduction, increased ATP and DNA synthesis, and stimulation of muscle, tendon, and nerve regeneration.<sup>26</sup> Laser acupuncture also activates specific regions of the brain as shown with functional magnetic resonance imaging.<sup>27</sup> Acupuncture studies using functional brain imaging help elucidate effects and pathways linking peripheral stimulation, cortical brain changes and empirically-validated effects on internal organs.<sup>28</sup>

Not all are convinced of the efficacy of LPLs, however. According to Baxter, “[T]here remains a considerable amount of ignorance and skepticism concerning laser’s use and clinical efficacy.”<sup>29</sup> Critics attribute the effects of low power lasers to placebo, and liken the power of an LPL to “at close range pack about the same ‘radiation’ punch as a small flashlight with a piece of red cellophane over the front.”<sup>30</sup> While LPL devices such as laser pointers can cost as little as \$11, more sophisticated devices cost hundreds, even thousands of dollars, causing some to raise questions about financial exploitation by suppliers of these devices.<sup>31 32</sup>

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<sup>22</sup> Naeser MA. Neurological rehabilitation: acupuncture and laser acupuncture to treat paralysis in stroke, other paralytic conditions, and pain in carpal tunnel syndrome. *J Alt Compl Medicine*. 1997;3:425-428.

<sup>23</sup> Kendall DE. Chapter 14, “Mechanisms of Action”. *Dao of Chinese Medicine; Understanding an Ancient Healing Art*. New York: Oxford University Press, 2002. Pp. 256-285.

<sup>24</sup> Baxter, Op. cit., p. 87.

<sup>25</sup> Pontinen, op. cit.

<sup>26</sup> Pontinen, Op. cit.

<sup>27</sup> Siedentopf CM et al. Functional magnetic resonance imaging detects activation of the visual association cortex during laser acupuncture of the foot in humans. *Neurosci Lett*. 2002;327:53-56.

<sup>28</sup> Cho ZH et al. New findings of the correlation between acupoints and corresponding brain cortices using functional MRI. *Proc. Natl. Acad. Sci. USA*. 1998;95:2670-2673.

<sup>29</sup> Baxter GD. Op. cit.

<sup>30</sup> Devor M. What’s in a laser beam for pain therapy? *Pain*. 1990;43:139. Cited in Mendelson G. Laser acupuncture [Letter]. *Med J Australia*. 1991; 154:779.

<sup>31</sup> Ibid.

<sup>32</sup> Mendelson G. Laser acupuncture [Letter]. *Med J Australia*. 1991;154:779.

Much of the enthusiasm for LPLs in the past has been based on uncontrolled trials and case reports<sup>33 34 35</sup>. Critics of LPL therapy point out that results of controlled trials are inconsistent, with some studies showing promise (for carpal tunnel syndrome, pain reduction, nocturnal enuresis, pediatric postoperative vomiting, and cervical myofascial pain)<sup>36 37 38 39 40 41</sup> and others showing no difference between laser and control treatments (in asthma, smoking cessation, and other pain problems).<sup>42 43 44 45 46 47</sup> Possible reasons for failure in the latter group may be linked to faulty protocol design (such as using a single treatment rather than repeated applications) and lack of awareness of the laser parameters required to successfully treat a given condition. These parameters include: wavelength, output power, radiant power, waveform, and joules delivered per unit area.<sup>48</sup> According to Pöntinen, "Mainly because of widespread ignorance of laser parameters, thousands of laser treatments have been given with irradiation doses far below those that are clinically effective."<sup>49</sup> Primarily, practitioners and researchers using lasers need to consider the power of the laser (in watts or

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<sup>33</sup> Baldry P. Chapter 12, "Laser Therapy" in *Medical Acupuncture: A Western Scientific Approach*. Filshie J and White A (eds.) Edinburgh: Churchill Livingstone, 1998, pp. 193-201.

<sup>34</sup> Hu G. Treatment of pain by laser irradiation. *J Trad Chin Med*. 1989;9:256-258.

<sup>35</sup> Read A et al. Reducing Naltrexone-resistant hyperphagia using laser acupuncture to increase endogenous opiates. *Brain Injury*. 1996;10:911-919.

<sup>36</sup> Naeser MA et al. Carpal tunnel syndrome pain treated with low-level laser and microamperes Transcutaneous electrical nerve stimulation: a controlled study. *Arch Phys Med Rehabil*. 2002;83:978-988.

<sup>37</sup> King CE et al. Effect of helium-neon laser auriculotherapy on experimental pain threshold. *Physical Therapy*. 1990;70:38-44.

<sup>38</sup> Radmayr C et al. Acupunktur – eine Konkurrenz zu Desmopressin bei Enuresis nocturna. *Forsch Komplementärmed Klass Naturheilkd*. 2002;9:177-185.

<sup>39</sup> Schlager A et al. Laser stimulation of acupuncture point P6 reduces postoperative vomiting in children undergoing strabismus surgery. *Br J Anaesth*. 1998;81:529-532.

<sup>40</sup> Ceccherelli F et al. Diode laser in cervical myofascial pain: a double-blind study versus placebo. *Clin J Pain*. 1989;5:301-304.

<sup>41</sup> Radmayr C et al. Prospective randomized trial using laser acupuncture versus desmopressin in the treatment of nocturnal enuresis. *Eur Urol*. 2001;40:201-205.

<sup>42</sup> Waylonis GW et al. Chronic myofascial pain: management by low-output helium-neon laser therapy. *Arch Phys Med Rehabil*. 1988;69:1017-1020.

<sup>43</sup> Morton AR et al. Efficacy of laser-acupuncture in the prevention of exercise-induced asthma. *Annals of Allergy*. 1993;70:295-298.

<sup>44</sup> Lundeberg T et al. A comparative study of the pain-relieving effect of laser treatment and acupuncture. *Acta Physiol Scand*. 1987;131:161-162.

<sup>45</sup> Haker E and Lundeberg T. Laser treatment applied to acupuncture points in lateral humeral epicondylalgia. A double-blind study. *Pain*. 1990;43:243-7.

<sup>46</sup> Gruber W et al. Laser acupuncture in children and adolescents with exercise induced asthma. *Thorax*. 2002;57:222-225.

<sup>47</sup> Yiming C et al. Laser acupuncture for adolescent smokers – a randomized double-blind controlled trial. *Am J Chin Med*. 2000;28:443-449.

<sup>48</sup> Pöntinen PJ. Chapter 17, "Low-energy photon therapy" in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

<sup>49</sup> Pöntinen PJ. Chapter 17, "Low-energy photon therapy" in Schoen AM and Wynn SG (eds.): *Complementary and Alternative Veterinary Medicine, Principles and Practice*. St. Louis: Mosby, 1998. pp. 247-274.

milliwatts), the amount of surface area to be treated, and the time it will take to produce an effective radiation dose.<sup>50</sup> Evidence suggests that the optimal dose for HeNe laser treatment through the skin is between 0.1 and 1 joule per acupuncture point.<sup>51</sup> Furthermore, as with medication that requires repeated administration, LPL effects become cumulative; a single treatment as provided in the negative studies on asthma, may fail to produce significant benefit.<sup>52</sup> Depth of the problem is similarly important. Since laser light penetrates no more deeply than natural light, superficial pain and soft tissue problems may react more strongly than deeper ones<sup>53</sup>. In the end, acupuncture needling may still be more effective than laser stimulation of acupuncture points.<sup>54</sup>

Considering the popularity of LPLs among the lay public, it is fortunate that the potential adverse effects are minimal. Risk of eye injury is low,<sup>55</sup> but users should nonetheless take care to avoid directing the beam toward the eye. According to Pöntinen, the photon energy employed in biostimulation and pain reduction is not ionizing and therefore does not produce cancer.<sup>56</sup> In comparison, Baxter considers the presence of active neoplasia to be a contraindication to laser therapy, because laser irradiation mediates the release of growth factors.<sup>57</sup> Additional contraindications include the presence of pacemakers, pregnancy, hemorrhage, uncontrolled epilepsy.<sup>58</sup> <sup>59</sup> Prudent practice suggests that lasers should not be applied to gonadal tissue, the epiphyseal plates of immature animals, autonomic nerve trunks, and photosensitive tissue.<sup>60</sup>

Cost comparisons of low-power laser therapy vs. other forms of treatments for humans with carpal tunnel syndrome or recovering from stroke show savings of tens of thousands of dollars per case.<sup>61</sup> Perhaps in the future, side-by-side controlled comparisons of complementary and conventional treatment approaches will become widely available in veterinary medicine. Analyses of relative efficacy, safety and cost of various treatment strategies for the same condition would provide veterinary medical practitioners the vital resources they

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<sup>50</sup> Pontinen, Op. cit.

<sup>51</sup> Pontinen, Op. cit.

<sup>52</sup> Gruber W et al. Op. cit.

<sup>53</sup> Baldry, Op. cit.

<sup>54</sup> Brockhaus A and Elger CE. Hypalgesic efficacy of acupuncture on experimental pain in man.

Comparison of laser acupuncture and needle acupuncture. *Pain*. 1990;43:181-185.

<sup>55</sup> Pontinen, op. cit.

<sup>56</sup> Pontinen, op. cit.

<sup>57</sup> Baxter, Op. cit., p. 59.

<sup>58</sup> Pontinen, op. cit.

<sup>59</sup> Baxter, op. cit, pp. 58-65.

<sup>60</sup> Baxter, op. cit, pp. 58-65

<sup>61</sup> Naeser MA. Neurological rehabilitation: acupuncture and laser acupuncture to treat paralysis in stroke, other paralytic conditions, and pain in carpal tunnel syndrome. *J Alt Compl Medicine*. 1997;3:425-428.

need to help their clients make the most rational and informed decisions that are guided by evidence, rather than tradition or opinion.<sup>62</sup>

Figure 1: Low-power laser acupuncture (red light), in conjunction with needle acupuncture, applied to ventrum of a cockatoo with self-mutilation wounds



Figure 2: Label from low-power laser diode, showing wavelength and power specifications.



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<sup>62</sup> Woolf SH. The need for perspective in evidence-based medicine. *JAMA*. 1999;282:2358-2365.