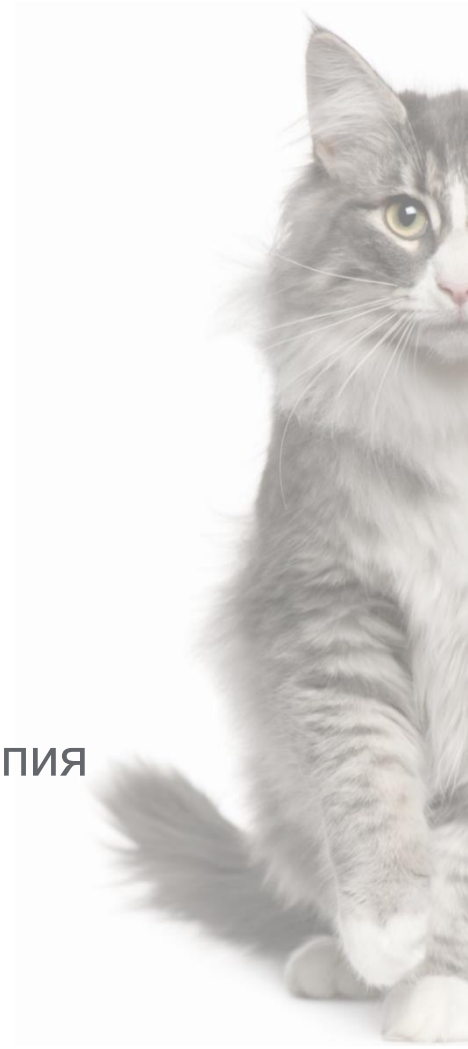
РЕШЕНИЯ ДЛЯ ВЕТЕРИНАРИИ

ПРЕЗЕНТАЦИЯ

СОДЕРЖАНИЕ

СОДЕРЖАНИЕ

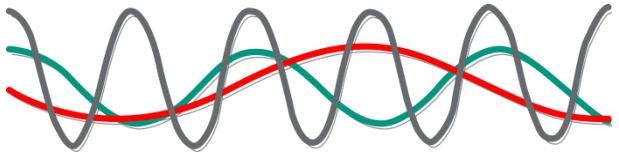


I. ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ

ФОТОТЕРАПИЯ II.

- **ЛАЗЕР – «УСИЛЕНИЕ СВЕТА ПОСРЕДСТВОМ ВЫНУЖДЕННОГО ИЗЛУЧЕНИЯ» (ОТ АНГЛ. LASER – LIGHT AMPLIFICATION BY THE STIMULATED EMISSION OF RADIATION)**

- **Монохроматичность**
  - Только одна длина волны
- **Поляризация**
  - Направленность
- **Когерентность**
  - Синхронизация фаз



Некогерентные полихроматические волны

Некогерентные монохроматические волны

Когерентные монохроматические волны

ИСТОЧНИКИ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ

- **ИСТОЧНИКИ ЛАЗЕРНОГО ИЗЛУЧЕНИЯ КЛАССИФИЦИРУЮТ В ЗАВИСИМОСТИ ОТ ДЛИНЫ ВОЛНЫ И МАКСИМАЛЬНОЙ ВЫХОДНОЙ МОЩНОСТИ:**

  - Классы от **I.** до **III.R** – в основном **промышленное применение**
  - Класс **III.B** – стандартная **НИЛИ** (до 500 мВт)
  - Класс **IV.**
    - **Лазер высокой интенсивности**
    - **Лазерная хирургия**

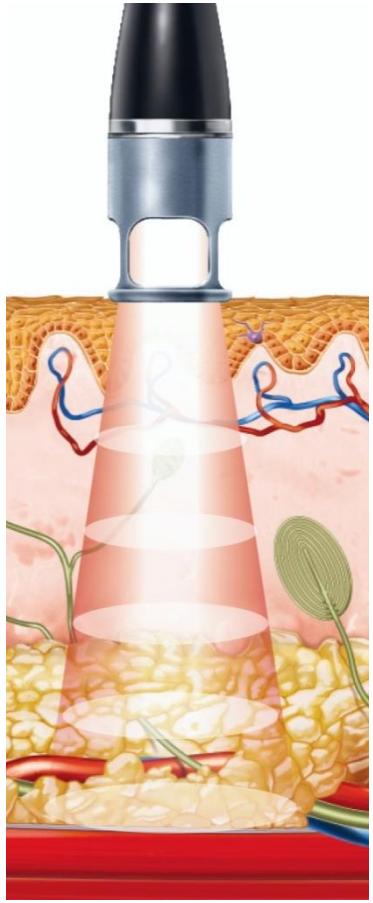
ФОТОТЕРАПИЯ I

- **БИОЛОГИЧЕСКИЕ СИСТЕМЫ ЕСТЕСТВЕННЫМ ОБРАЗОМ РЕАГИРУЮТ НА ЭНЕРГИЮ СВЕТОВОГО ИЗЛУЧЕНИЯ**
  - Технологический прогресс позволил добиться максимального терапевтического воздействия на ткани
  - Низкоинтенсивная лазерная терапия (НИЛИ, холодный лазер)
  - **Высокоинтенсивная лазерная терапия**
    - Мощность **0,5 – 12 Вт**
    - Длина волны 810–**1064 нм**
    - **Лазер 4 класса**

ЛАЗЕРЫ 4 КЛАССА

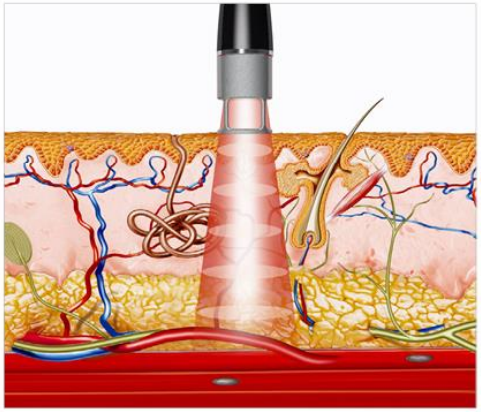
- **ЛАЗЕРЫ 4 КЛАССА МОГУТ БЫТЬ КАК ХИРУРГИЧЕСКИМИ, ТАК И ТЕРАПЕВТИЧЕСКИМИ**

  - Действие лазера определяется **концентрацией энергии** – в пространстве и во времени.
  - **Хирургический лазерный луч** – энергия, сконцентрированная в тонком луче, приводит к разрушению ткани
  - **Терапевтический лазерный луч –** дисперсия такого же количества энергии приводит к выраженной стимуляции тканей



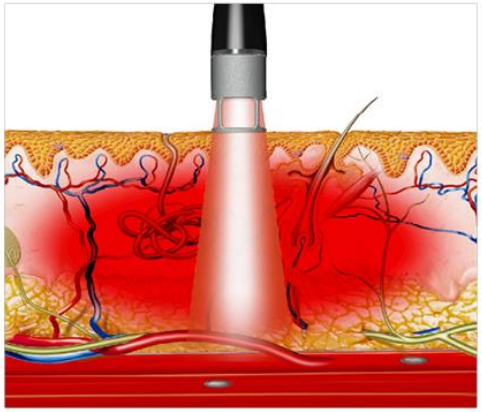
БИОЛОГИЧЕСКИЙ ЭФФЕКТЫ ЛАЗЕРНОЙ ТЕРАПИИ

АНАЛЬГЕТИЧЕСКИЙ ЭФФЕКТ



БИОСТИМУЛЯЦИЯ

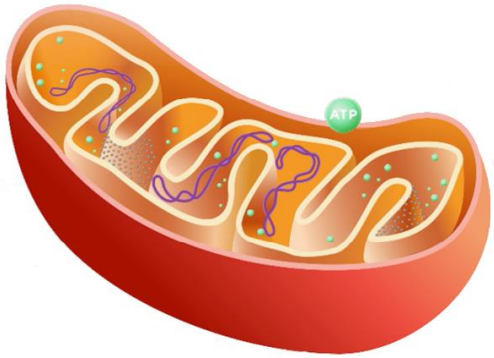
ТЕРМИЧЕСКИЙ ЭФФЕКТ



ЛАЗЕРНОЕ ИЗЛУЧЕНИЕ – ЭФФЕКТ БИОСТИМУЛЯЦИИ

- **СТИМУЛЯЦИЯ УСКОРЕННОГО ЗАЖИВЛЕНИЯ БОЛЬШИНСТВА БИОЛОГИЧЕСКИХ ТКАНЕЙ**

  - **Репликация** митохондриальной **РНК**
  - Деление митохондрий
  - Увеличение **синтеза АТФ**
  - Увеличение синтеза ядерной ДНК

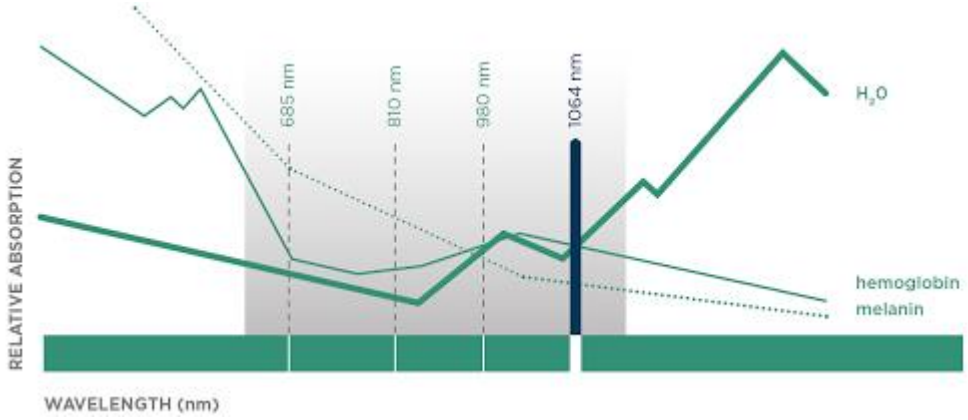


ЛАЗЕРНОЕ ИЗЛУЧЕНИЕ – ПРОТИВОВОСПАЛИТЕЛЬНЫЙ ЭФФЕКТ

- **СТИМУЛЯЦИЯ КЛЕТОК ИММУННОЙ СИСТЕМЫ**
  - Пролиферация и миграция полиморфноядерный нейтрофилов
  - Активация моноцитов
- **СНИЖЕНИЕ УРОВНЯ ПРОСТОГЛАНДИНА E2 (PGE2)**
- **ПОДДЕРЖАНИЕ СЕКРЕЦИИ ПРОСТАЦИКЛИНА (PGI2)**

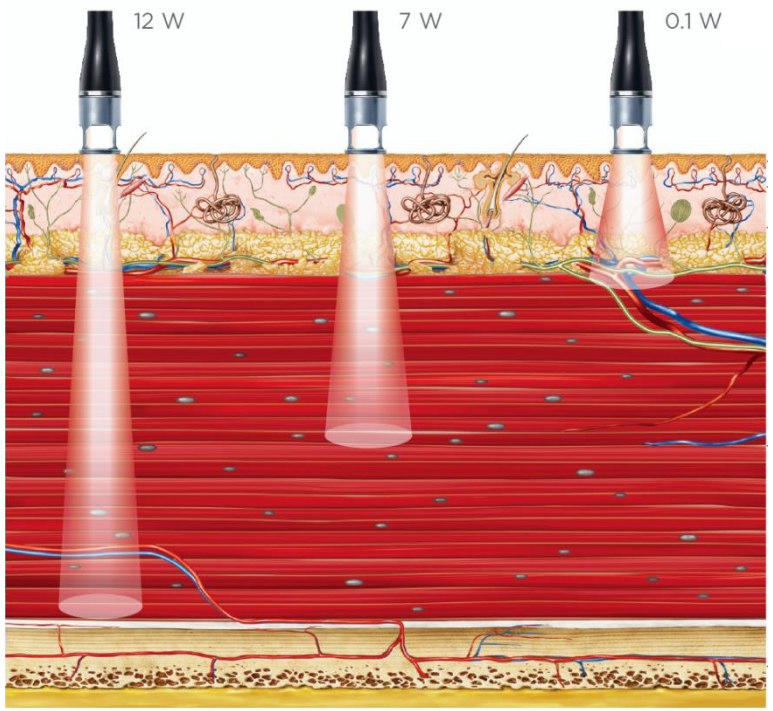
ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ – ЭФФЕКТ АНАЛЬГЕЗИИ

- Длина волны около **1000 нм** + мощность **более 7 Вт**
- Мгновенное и выраженное уменьшение боли
  - В импульсном режиме очень короткие импульсы создают в тканях **«фотомеханическую волну»**
  - Фотомеханическая стимуляция **блокирует болевые** импульсы

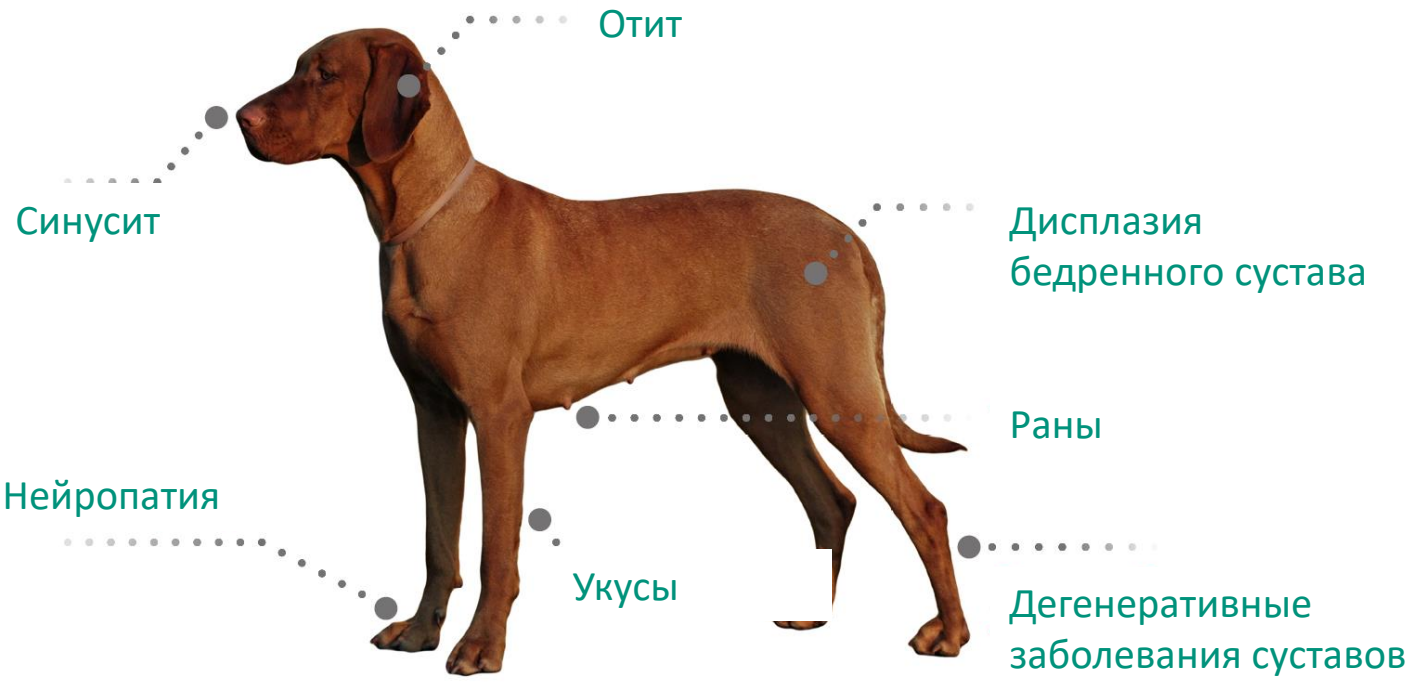


СРАВНЕНИЕ ЛАЗЕРА ВЫСОКОЙ ИНТЕНСИВНОСТИ И НИЛИ

- **ПРЕИМУЩЕСТВА ПО СРАВНЕНИЮ С ХОЛОДНЫМИ ЛАЗЕРАМИ (НИЛИ)**
  - **В 30 – 50** раз большая мощность
  - **Оптимальная длина волны**
  - Неограниченная **глубина проникновения**
  - **Более короткие лечебные процедуры**
  - **Лечение боли**
  - Более широкий **спектр показаний**
    - От острой травмы до хронического артрита
  - Более благоприятные **клинические исходы и высокая удовлетворенность пациентов**



НАИБОЛЕЕ РАСПРОСТРАНЕННЫЕ ПОКАЗАНИЯ*



*Наиболее распространенные показания. Полный список показаний для крупных/мелких животных можно найти в Энциклопедии терапии лазером высокой интенсивности.

ПРОТИВОПОКАЗАНИЯ

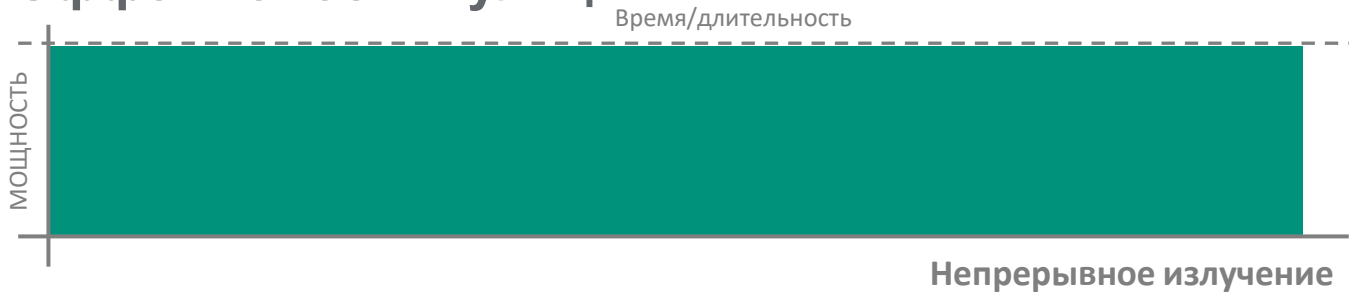
- **АБСОЛЮТНЫЕ ПРОТИВОПОКАЗАНИЯ**
  - Область глаз – возможно повреждение сетчатки
  - Опухоли
  - Область эндокринных желез
  - Татуировки, пигментация

- **ОТНОСИТЕЛЬНЫЕ ПРОТИВОПОКАЗАНИЯ**
  - Эпилепсия
  - Лихорадка
  - Беременность
  - Снижение чувствительности в обрабатываемой области
  - Прием препаратов, вызывающих фоточувствительность
  - Инъекции кортизона
  - Металлические имплантаты

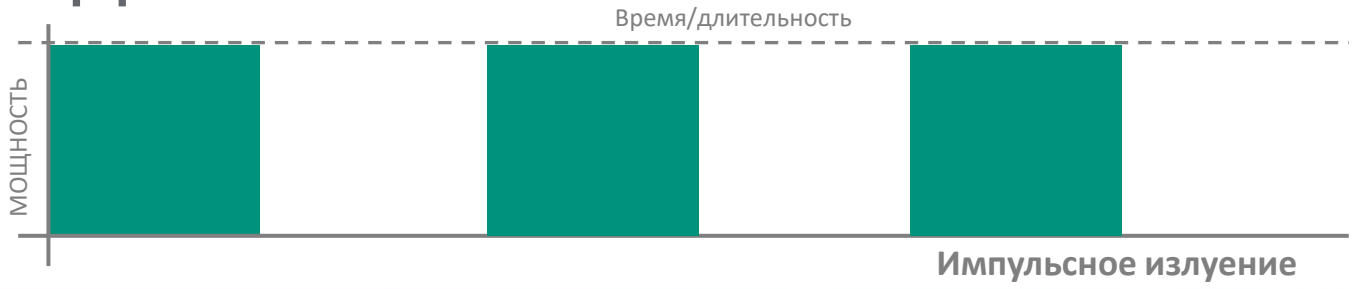
ПРОЦЕДУРА ЛЕЧЕНИЯ

- **РЕЖИМ ИЗЛУЧЕНИЯ ОПРЕДЕЛЯЕТ ТЕРАПЕВТИЧЕСКИЙ ЭФФЕКТ:**

  - **Эффект биостимуляции**



  - **Эффект анальгезии**



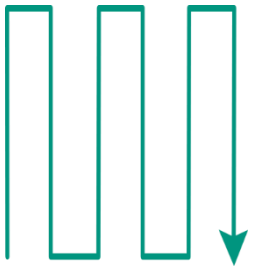
ПРОТОКОЛ ЛЕЧЕНИЯ – ОБЩИЙ

- **РЕКОМЕНДОВАНО ПРОВОДИТЬ ПРОЦЕДУРУ В ДВА ЭТАПА:**

1. **Режим анальгезии/ импульсный режим** (25Гц)
   - Оптимален для **уменьшения боли**
   - **1ый этап** процедуры
   - Нетепловое воздействие

Спиральные движения в режиме анальгезии

2. **Режим биостимуляции/ непрерывный режим**
   - Максимальная **биостимуляция**, противовоспалительный эффект
   - **2ой этап** процедуры



Непрерывные «сканирующие» движения в режиме биостимуляции

ПРОЦЕДУРА ЛЕЧЕНИЯ I

- **ОСМОТР**
- **ПОДГОТОВКА ПАЦИЕНТА**
  - Размещение пациента
  - Бритье обрабатываемой области
  - Установка параметров лечения в соответствии с заболеванием. Следует принять во внимание:
    - Чувствительность пациентов со светлой кожей
    - Абсорбцию при темной шерсти
- **ЛЕЧЕНИЕ**

ПРОЦЕДУРА ЛЕЧЕНИЯ II

- **ЛЕЧЕНИЕ**
  - Длительность процедуры составляет приблизительно 5-10 мин.
  - Используйте подходящий протокол лечения из Энциклопедии
  - Непосредственное воздействие на обрабатываемую область
  - Фаза анальгезии:
    - Начните процедуру на расстоянии 3-5 см от области максимальной болезненности, постепенно приближаясь к ней с помощью спиралевидных движений
  - Фаза биостимуляции:
    - Используйте непрерывные «сканирующие» движения
    - Чтобы избежать перегрева, рекомендуется проверять температуру кожи.

ПРОВЕДЕНИЕ ПРОЦЕДУРЫ

ПРОВЕДЕНИЕ ПРОЦЕДУРЫ

PLUM (самка)

Показания: открытая рана 200 см², некроз кожи.
Процедуры: 10, фокус на краях раны + повязка Algoplaque

ДО

ПОСЛЕ

BENNY (самец)

Показания: фистула на фоне анального саккулита.
Процедуры: всего 5; 3 каждые 24 ч, затем 2 каждые 48 часов – 8 дней

ДО

ПОСЛЕ

CAPITAN (самец)

Показания: фиброма влагалища сгибателя в области вторичного квартиля медиальной плантарной поверхности с вовлечением синовиального влагалища
Процедуры: 4; 1 раз в неделю.

ДО

ПОСЛЕ

ESTRELA (самка)

Показания: прогрессирующая проприоцептивная атаксия задних конечностей, грыжа диска T11-T12
Процедуры: 5

ДО

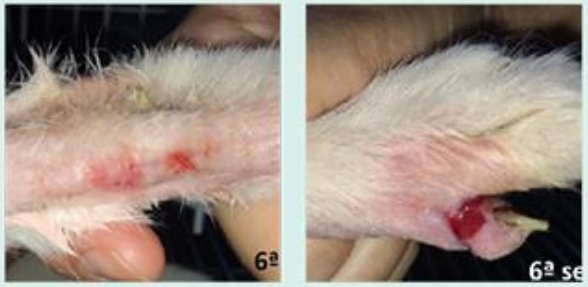
ПОСЛЕ

GALILEU (самец)

Показания: акральный дерматит и отрыв мягких тканей II пальца левой задней конечности с вовлечением медиальной и дистальной фаланг, вызванный дракой с другим котом
Процедуры: 7, ежедневно с последующей перевязкой; после 1-ой процедуры наблюдается грануляция раны, закрытие поверхности кости уже через 24 ч

ДО

ПОСЛЕ



GASTÃO (самец)

Показания: глубокая фистула на фоне анального саккулита.
Процедуры: 7, ежедневно

ДО

ПОСЛЕ

MAX (самец)

Показания: отрыв мягких тканей в области медиальной зоны тибиотарзального сустава, обнажен дистальный конец большеберцовой кости.
Процедуры: 5, ежедневно с последующим наложением повязки, после первой процедуры рана заполнена грануляционной тканью

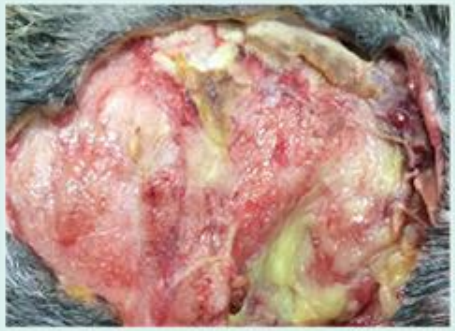
ДО

ПОСЛЕ

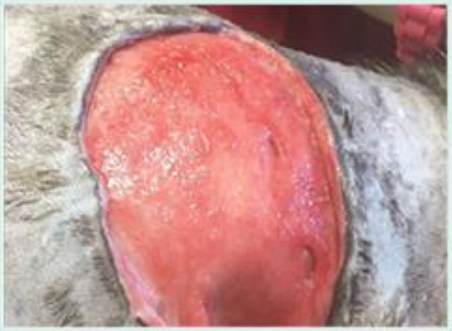
PETIT GATEAU (самец)

Показания: распространенная флегмона ПЖК области грудной клетки, некроз кожи, подкожных тканей и мышц после укуса собаки
Процедуры: 20; 10 ежедневно, 10 через день с последующим наложением повязки.

ДО



ПОСЛЕ

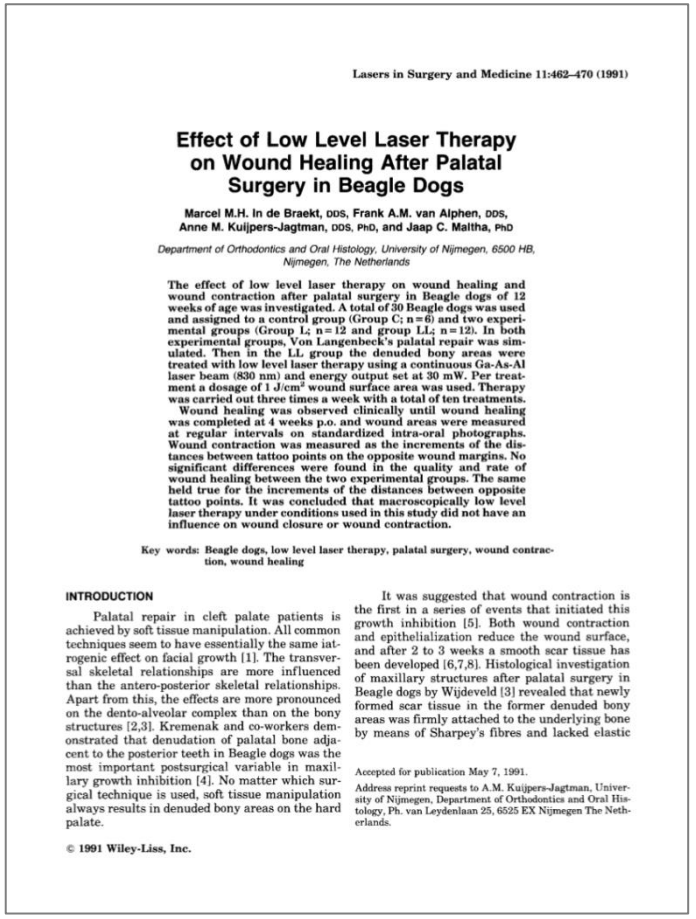


КЛИНИЧЕСКИЕ ДАННЫЕ

EFFECT OF LOW LEVEL LASER THERAPY ON WOUND HEALING AFTER PALATAL SURGERY IN BEAGLE DOGS

Authors: Marcel M.H. In de Braekt, DDS, Frank A.M. van Alphen, DDS, Anne M. Kuijpers-Jagtrnan, DDS, phd, and Jaap C. Maltha, phd

Source: Lasers in surgery and medicine 11:462-470 (1991)



Lasers in Surgery and Medicine 11:462–470 (1991)

Effect of Low Level Laser Therapy on Wound Healing After Palatal Surgery in Beagle Dogs

Marcel M.H. In de Braekt, DDS, Frank A.M. van Alphen, DDS, Anne M. Kuijpers-Jagtman, DDS, PhD, and Jaap C. Maltha, PhD

Department of Orthodontics and Oral Histology, University of Nijmegen, 6500 HB, Nijmegen, The Netherlands

The effect of low level laser therapy on wound healing and wound contraction after palatal surgery in Beagle dogs of 12 weeks of age was investigated. A total of 30 Beagle dogs was used and assigned to a control group (Group C; n = 6) and two experimental groups (Group L; n = 12 and group LL; n = 12). In both experimental groups, Von Langenbeck's palatal repair was simulated. Then in the LL group the denuded bony areas were treated with low level laser therapy using a continuous Ga-As-Al laser beam (830 nm) and energy output set at 30 mW. Per treatment a dosage of 1 J/cm² wound surface area was used. Therapy was carried out three times a week with a total of ten treatments.

Wound healing was observed clinically until wound healing was completed at 4 weeks p.o. and wound areas were measured at regular intervals on standardized intra-oral photographs. Wound contraction was measured as the increments of the distances between tattoo points on the opposite wound margins. No significant differences were found in the quality and rate of wound healing between the two experimental groups. The same held true for the increments of the distances between opposite tattoo points. It was concluded that macroscopically low level laser therapy under conditions used in this study did not have an influence on wound closure or wound contraction.

Key words: Beagle dogs, low level laser therapy, palatal surgery, wound contraction, wound healing

INTRODUCTION

Palatal repair in cleft palate patients is achieved by soft tissue manipulation. All common techniques seem to have essentially the same iatrogenic effect on facial growth [1]. The transversal skeletal relationships are more influenced than the antero-posterior skeletal relationships. Apart from this, the effects are more pronounced on the dento-alveolar complex than on the bony structures [2,3]. Kremenak and co-workers demonstrated that denudation of palatal bone adjacent to the posterior teeth in Beagle dogs was the most important postsurgical variable in maxillary growth inhibition [4]. No matter which surgical technique is used, soft tissue manipulation always results in denuded bony areas on the hard palate.

It was suggested that wound contraction is the first in a series of events that initiated this growth inhibition [5]. Both wound contraction and epithelialization reduce the wound surface, and after 2 to 3 weeks a smooth scar tissue has been developed [6,7,8]. Histological investigation of maxillary structures after palatal surgery in Beagle dogs by Wijdeveld [3] revealed that newly formed scar tissue in the former denuded bony areas was firmly attached to the underlying bone by means of Sharpey's fibres and lacked elastic

Accepted for publication May 7, 1991.

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КЛИНИЧЕСКИЕ ДАННЫЕ

LOW-LEVEL LASER THERAPY FOR WOUND HEALING: MECHANISM AND EFFICACY

Authors: William Posten, MD David A. Wrone, MD Jeffrey S. Dover, MD, FRCPC, Kenneth A. Arndt, MD Sirunya Silapu NT, MD and Murad Alam, MDW

Source: Dermatol Surg 31:3:March 2005

EVIDENCE-BASED MEDICINE/OUTCOMES RESEARCH

Low-Level Laser Therapy for Wound Healing: Mechanism and Efficacy

WILLIAM POSTEN, MD,* DAVID A. WRONE, MD,† JEFFREY S. DOVER, MD, FRCPC,‡§‖ KENNETH A. ARNDT, MD,‡§‖¶ SIRUNYA SILAPUNT, MD,** AND MURAD ALAM, MD†

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BACKGROUND. Given the recent interest in light-emitting diode (LED) photomodulation and minimally invasive nonablative laser therapies, it is timely to investigate reports that low-level laser therapy (LLLT) may have utility in wound healing.

OBJECTIVES. To critically evaluate reported in vitro models and in vivo animal and human studies and to assess the qualitative and quantitative sufficiency of evidence for the efficacy of LLLT in promoting wound healing.

METHOD. Literature review, 1965 to 2003.

RESULTS. In examining the effects of LLLT on cell cultures in vitro, some articles report an increase in cell proliferation and collagen production using specific and somewhat arbitrary laser settings with the helium neon (HeNe) and gallium arsenide lasers, but none of the available studies address the mechanism, whether photothermal, photochemical, or photomechanical, whereby LLLT may be exerting its effect. Some studies, especially those using HeNe lasers, report improvements in surgical wound healing in a rodent model; however, these results have not been duplicated in animals such as pigs, which have skin that more closely resembles that of humans. In humans, beneficial effects on superficial wound healing found in small case series have not been replicated in larger studies.

CONCLUSION. To better understand the utility of LLLT in cutaneous wound healing, good clinical studies that correlate cellular effects and biologic processes are needed. Future studies should be well-controlled investigations with rational selection of lasers and treatment parameters. In the absence of such studies, the literature does not appear to support widespread use of LLLT in wound healing at this time. Although applications of high-energy (10–100 W) lasers are well established with significant supportive literature and widespread use, conflicting studies in the literature have limited low-level laser therapy (LLLT) use in the United States to investigational use only. Yet LLLT is used clinically in many other areas, including Canada, Europe, and Asia, for the treatment of various neurologic, chiropractic, dental, and dermatologic disorders. To understand this discrepancy, it is useful to review the studies on LLLT that have, to date, precluded Food and Drug Administration approval of many such technologies in the United States. The fundamental question is whether there is sufficient evidence to support the use of LLLT.

WILLIAM POSTEN, MD, DAVID A. WRONE, MD, JEFFREY S. DOVER, MD, FRCPC, KENNETH A. ARNDT, MD, SIRUNYA SILAPUNT, MD, AND MURAD ALAM, MD, HAVE INDICATED NO SIGNIFICANT INTEREST WITH COMMERCIAL SUPPORTERS.

Background

LOW-LEVEL laser therapy (LLLT) as a therapeutic modality was introduced by the work of Mester and colleagues, who noted improvement in wound healing with application of a low-energy (1 J/cm^2) ruby laser.[1–3] This generated an increased interest in understanding and developing further low-energy laser technologies and applications.

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LLLT is defined by several parameters. The primary defining factor is power with a range of 10^{-3} to 10^{-1} W. Other significant parameters include a wavelength between 300 and 10,600 nm, a pulse rate of 0 (continuous) to 5,000 Hz, a pulse duration of 1 to 500 milliseconds, an interpulse interval of 1 to 500 milliseconds, a total irradiation time of 10 to 3,000 seconds, an intensity (power/area) of 10^{-2} to 10^{0} W/cm^2, and a dose (power × irradiation time/area irradiated) of 10^{-2} to 10^{2} J/cm^2.[4] Differences in the parameters used in various studies complicate the issue of making meaningful comparisons.

Various substrates have been used to create the lasers used for LLLT. Initial research used lasers based

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КЛИНИЧЕСКИЕ ДАННЫЕ

EFFICACY OF THREE DIFFERENT LASER WAVELENGTHS FOR IN VITRO WOUND HEALING

Authors: Denise Hawkins-Evans & Heidi Abrahamse

Source: Photodermatology, Photoimmunology & Photomedicine 24, 199–210

ORIGINAL ARTICLE

Efficacy of three different laser wavelengths for *in vitro* wound healing

Denise Hawkins-Evans & Heidi Abrahamse

Laser Research Group, Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa

Key words:
biological responses; 830 nm diode; helium-neon; Nd:YAG; phototherapy; wound

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5 March 2008

Conflicts of interest:
None declared.

Summary

Background and objective: Despite contradictory reports on the effect of laser light on cell proliferation, studies have shown that appropriate doses and wavelengths of laser light are therapeutically beneficial in tissue repair and pain control. This study aimed to establish if the dose and/or wavelength influenced the biological responses of irradiated in vitro fibroblasts – 1 h after laser irradiation.

Materials and methods: This study aimed to establish cellular responses of normal and wounded human skin fibroblasts to helium-neon (632.8 nm), diode (830 nm) and Nd:YAG (1064 nm) laser irradiation using one exposure of 5 or 16 J/cm^2 on day 1 and again on day 4.

Results: Wounded cells exposed to 5 J/cm^2 using 632.8 nm showed an increase in cell migration and haptotaxis, a stable increase in the release of interleukin-6 (IL-6), a decrease in caspase 3/7 activity, an increase in ATP viability and an increase in cell proliferation ~ 1 h after the final exposure. The results confirm that changes in parameters such as ATP viability, cytokine expression (IL-6), cell proliferation (alkaline phosphatase enzyme activity) and DNA damage can be observed directly after the laser irradiation. The amount of DNA damage and cytotoxicity may be related to duration of the laser irradiation, which is dependent on the power density (mW/cm^2) of each laser.

Conclusion: The results indicate that 5 J/cm^2 using 632.8 nm results in a stimulatory effect that is more effective than 830 and 1064 nm. The results suggest possible mechanisms by which the wavelength may potentially influence the cellular responses of wounded cells.

Low-level lasers improve wound healing (1, 2). Cell proliferation and protein expression are important steps in this process. Laser irradiation at certain fluences and wavelengths can enhance the release of growth factors from fibroblasts and stimulate cell proliferation in vitro (1). As a treatment modality low-level laser therapy (LLLT) remains controversial because the exact mechanism by which laser light causes photochemical reactions is still unknown and studies have argued that it simply does not work (3, 4). However, positive studies on cultured human fibroblasts have shown that helium-neon (HeNe, 632.8 nm) or near infrared low-level laser irradiation increases collagen production and cell number (4). Lack of quality control and poor experimental design has produced negative results in some studies and criticism of many of the positive studies (3). The most striking general feature in the negative studies is the use of very low doses, ineffective treatment techniques or inadequate conclusions on the observations made (5). Another important consideration is that successful in vitro results do not always directly translate to positive results in the in vivo application (6). Negative as well as positive studies are equally important in the search for optimal treatment parameters.

Karu (7) stated that the laser effect depends on the radiation wavelength, dose, and intensity as well as on the cell culture conditions. Many studies have examined the effect of LLLT on fibroblasts in culture. Almeida-Lopes et al. (2001), Pereira et al. (2002) and Azevedo et al. (2006) reported that laser irradiation stimulates fibroblast proliferation (8–10), while Colver and Priestley concluded that HeNe (633 nm, 5 mW, 1 mm diameter beam) laser irradiation (three times a day for 3 days) did not have a significant effect on cell proliferation or cellular migration (11).

The authors have published a series of papers confirming the positive effect of LLLT on human skin fibroblasts and have concluded the following:

(i) Studies have confirmed that the central scratch is sufficient to successfully induce a reproducible wound environment because there are specific cellular responses such as cell viability and cytotoxicity that distinguish wounded from normal un-irradiated cells (12–14).

(ii) Studies have shown that 5 J/cm^2 using a HeNe laser (632.8 nm, 3 mW/cm^2) stimulates migration, proliferation and mitochondrial activity of wounded fibroblasts to accelerate wound closure (14).

(iii) Higher doses (10 and 16 J/cm^2) of LLLT are characterized by a decrease in cell viability and cell proliferation with a

BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ

- **ДИЗАЙН И ПАРАМЕТРЫ**
  - Компактное **переносное устройство**
  - Выходная мощность до **12 Вт**
  - **Три спейсера**
  - Автоматическая **калибровка**

- **МЕРЫ ПО ОБЕСПЕЧЕНИЮ БЕЗОПАСНОСТИ**
  - **Ножная педаль** управления
  - **Визуальная и звуковая индикация**

- **ПРОСТОЕ УПРАВЛЕНИЕ**
  - **Сенсорный экран**

BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ-МОДЕЛИ

- **BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ 12 ВТ**
  - Выходная мощность **12 Вт**
  - Длина волны **1064 нм**

- **BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ 7 ВТ**
  - Выходная мощность **7 W**
  - Комбинированная длина волны **810/980 нм** (одновременно)

BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ- МОДЕЛИ

TECHNICAL SPECIFICATIONS	BTL–6000 HIGH INTENSITY LASER 12 W	BTL–6000 HIGH INTENSITY LASER 7 W
Part number	P6000.402	P6000.401
Total output	12 W in continuous mode	7 W in continuous mode
Operating wavelength	1064 nm	810 / 980 nm simultaneously
Mode of operation	continuous, pulsed, single pulse	
Number of protocols	61	
Safety features	emergency off switch operation by footswitch safety interlock	
Dimensions	320 × 190 × 280 mm	
Mains supply	230 V / 50–60 Hz, 115 V / 50–60 Hz	
Laser class	IV	
Equipment protection class	IIB	
Standard accessories	Footswitch control, navigation light, calibration block, safety applicator spacer 30 mm, safety eyewear 2 pieces, touch screen pointer	

Optional accessories

Part number P6000.412	Safety applicator spacer 10 mm	Part number P6000.211	BTL–6000 trolley
Part number P6000.414	Safety applicator spacer 60 mm	Part number P6000.210	Transportation case

BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ - МОДЕЛИ ХАРАКТЕРИСТИКИ

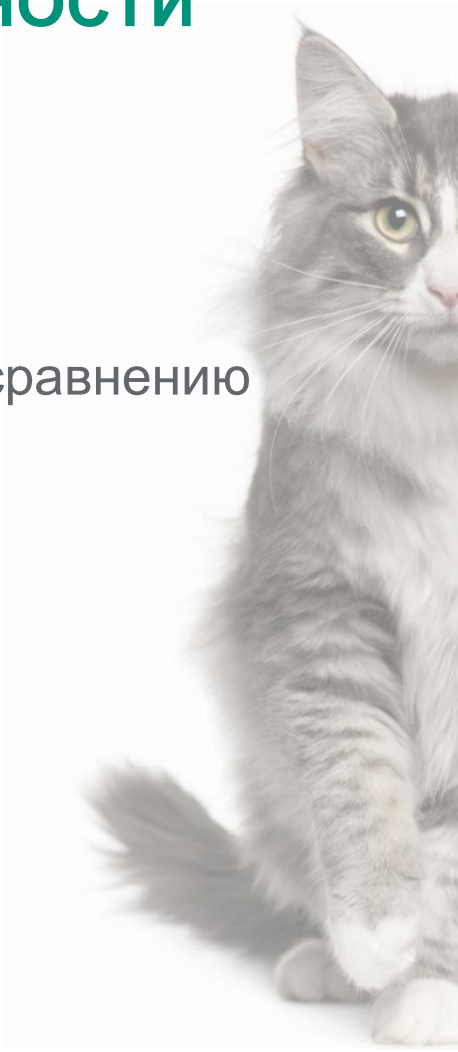
- **ЭРГОНОМИЧНЫЙ АППЛИКАТОР**
  - Эргономика, дизайн различные спейсеры на магнитном держателе


- **МОБИЛЬНОСТЬ**
  - Простота транспортировки – вес 7 кг, кейс для транспортировки

- **БЕЗОПАСНОСТЬ**
  - Защитные очки (для оператора и пациента)
  - Индикаторы безопасности
  - Управление помощью ножной педали


BTL-6000 ЛАЗЕР ВЫСОКОЙ ИНТЕНСИВНОСТИ

- Глубоко проникает в ткани (до 10 см)
- Широкий спектр показаний
- Короткое время процедуры
- В 10 – 15 раз более высокая доза энергии по сравнению с НИЛИ
- **Высокая клиническая эффективность и немедленный результат**

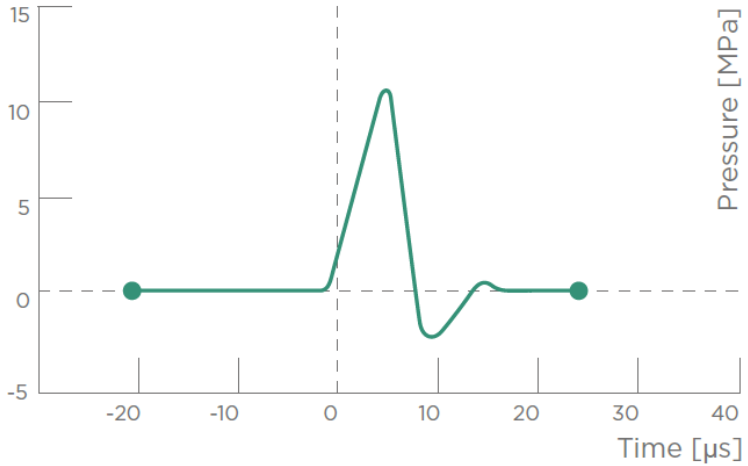


II. УДАРНО-ВОЛНОВАЯ ТЕРАПИЯ

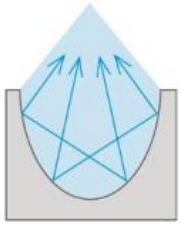
УДАРНАЯ ВОЛНА

- **УДАРНАЯ ВОЛНА – ЭТО АКУСТИЧЕСКАЯ ВОЛНА, НЕСУЩАЯ БОЛЬШОЕ КОЛИЧЕСТВО ЭНЕРГИИ К БОЛЕВОМУ ОЧАГУ, ЧТО СПОСОБСТВУЕТ ЗАЖИВЛЕНИЮ, РЕГЕНЕРАТИВНЫМ И РЕПАРАТИВНЫМ ПРОЦЕССАМ.**

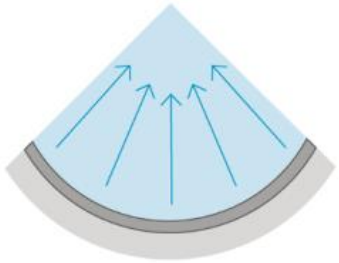
- **ОСНОВНЫЕ ОБЛАСТИ ПРИМЕНЕНИЯ**
  - Реабилитация в ветеринарии
  - Ортопедия в ветеринарии
  - Спортивная медицина в ветеринарии



ТЕХНОЛОГИИ УДАРНО-ВОЛНОВОЙ ТЕРАПИИ



электрогидравлическая



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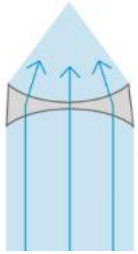
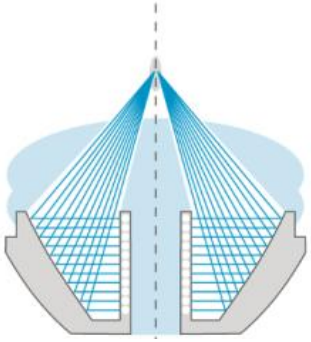
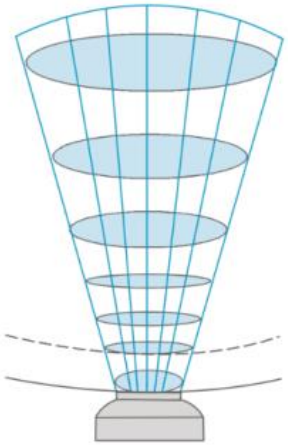


плоская электромагнитная катушка



цилиндрическая электромагнитная катушка



пневматическая

фокусированная

жесткая ударная волна

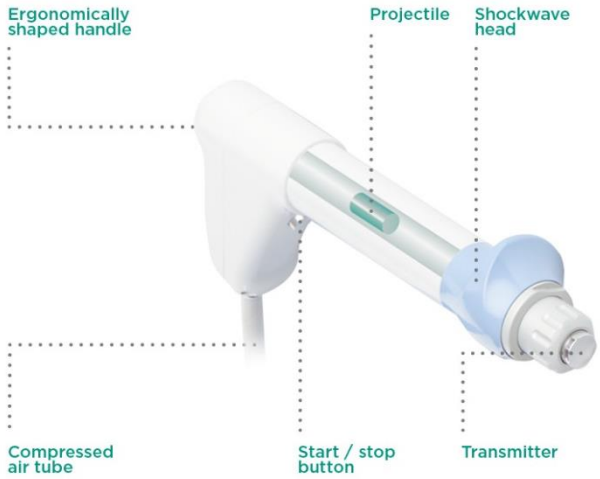
радиальная

мягкая ударная волна

ТЕХНОЛОГИЯ РАДИАЛЬНОЙ УДАРНО-ВОЛНОВОЙ ТЕРАПИИ

- **ПРИНЦИП**
  - Сжатый воздух запускает боек, который, в свою очередь, передает энергию на датчик

- **ХАРАКТЕРИСТИКИ**
  - Компактный и портативный
    - Всего 7 кг с учетом встроенного компрессора
  - Эргономичный аппликатор с длительным сроком эксплуатации
  - Возможность фокусирования при использовании специального датчика



МЕДИЦИНСКИЕ ЭФФЕКТЫ

- **ОБЕЗБОЛИВАНИЕ**
  - Рассасывание медиатора боли – субстанции р
  - Уменьшение мышечного напряжения
  - Расслабление триггерных точек
- **УСКОРЕНИЕ ЗАЖИВЛЕНИЯ**
  - Увеличение производства коллагена
  - Улучшение метаболизма и микроциркуляции
  - Образование новых кровеносных сосудов
  - Купирование хронического воспаления
- **ВОССТАНОВЛЕНИЕ ПОДВИЖНОСТИ**
  - Разрушение кальцифицированных фибробластов

УДАРНО-ВОЛНОВАЯ ТЕРАПИЯ. ПОКАЗАНИЯ*

Синдром Бострупа

Остеоартрит

Несрастающийся перелом

Хронический тендинит

Псевдоартрит

Подотрохлеит

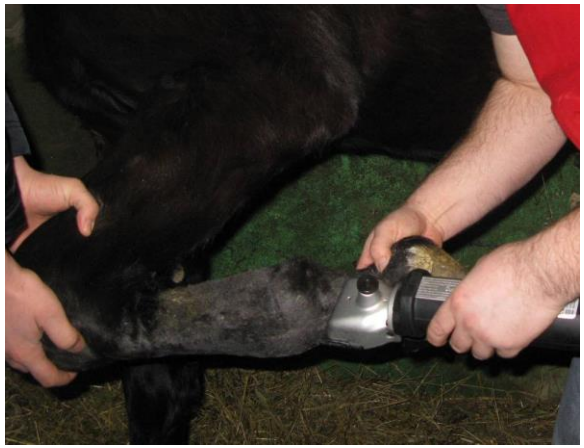
*Наиболее распространенные показания. Полный список показаний для крупных/мелких животных можно найти в Энциклопедии ударно-волновой терапии.

УДАРНОВОЛНОВАЯ ТЕРАПИЯ. ПРОТИВОПОКАЗАНИЯ

- Выраженный отек обрабатываемой зоны
- Воздействие в области головы, шеи, легких и непосредственно на позвоночный столб
- Снижение чувствительности обрабатываемой зоны
- Нарушение свертывания крови, прием антикоагулянтов
- Тромбоз
- Злокачественные новообразования, опухоли
- Острый инфекционный процесс
- Протезированный сустав
- Имплантированный стент или искусственный клапан сердца
- Область крупных кровеносных сосудов
- Область эпифизов, зоны роста костей
- Беременность
- Эструс

ПРОЦЕДУРА ЛЕЧЕНИЯ I

- **ОСМОТР**
- **ПОДГОТОВКА ПАЦИЕНТА**
  - Размещение пациента
  - Частичная седация (при необходимости)
  - Бритье обрабатываемой зоны
  - Нанесение проводящего геля
- **ЛЕЧЕНИЕ**



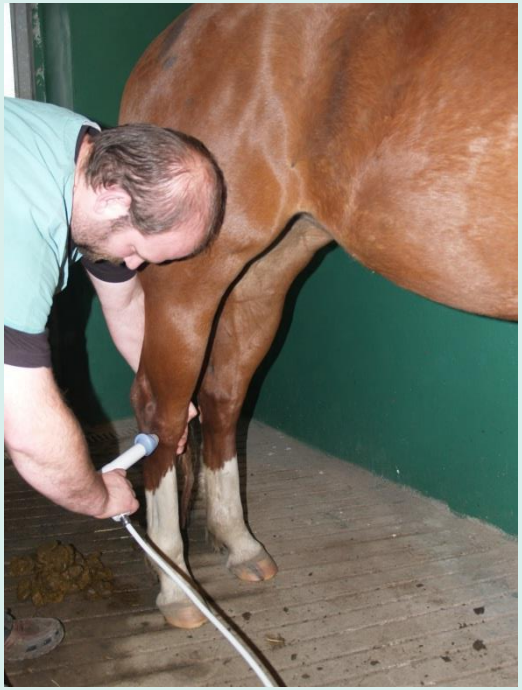
ПРОЦЕДУРА ЛЕЧЕНИЯ II

- **ЛЕЧЕНИЕ**
  - Обычно процедура занимает около 5-10 минут
  - Используйте подходящий протокол лечения из Энциклопедии
  - Воздействуйте непосредственно на обрабатываемую область
  - Подайте несколько импульсов в воздух рядом с животным, чтобы понаблюдать за его поведением
  - Начните воздействие за пределами зоны максимальной болезненности, после нескольких десятков импульсов смещайтесь по направлению к патологической области
  - Распределяйте воздействие равномерно по всей обрабатываемой зоне, однако обязательно избегайте воздействия на область позвоночного столба
  - Мощность можно регулировать в зависимости от ощущений пациента
  - После процедуры ударно-волновой терапии рекомендован режим покоя

ПРОВЕДЕНИЕ ПРОЦЕДУРЫ

Сесамовидная кость

Большеберцовая кость



КЛИНИЧЕСКИЕ ДАННЫЕ

ANTIBACTERIAL EFFECTS OF EXTRACORPOREAL SHOCK WAVES

Authors: Ludger Gerdesmeyer, Christof von Eiff, Carsten Horn, Mark Henne, Michaela Roessner, Peter Diehl, and Hans Gollwitzer

Source: Ultrasound in Med. & Biol., Vol. 31, No. 1, pp. 115–119, 2005

Ultrasound in Med. & Biol., Vol. 31, No. 1, pp. 115–119, 2005

0301-5629/05/$–see front matter

doi:10.1016/j.ultrasmedbio.2004.08.022

● *Original Contribution*

ANTIBACTERIAL EFFECTS OF EXTRACORPOREAL SHOCK WAVES

LUDGER GERDESMEYER,* CHRISTOF VON EIFF,† CARSTEN HORN,* MARK HENNE,* MICHAELA ROESSNER,* PETER DIEHL,* and HANS GOLLWITZER*‡

*Klinik und Poliklinik für Orthopädie und Sportorthopädie der Technischen Universität München, München, Germany; and †Institut für Medizinische Mikrobiologie, Universitätsklinikum Muenster, Muenster, Germany

(*Received* 10 *May* 2004, *revised* 23 *August* 2004, *accepted* 26 *August* 2004)

Abstract—Despite considerable knowledge about effects of extracorporeal shock-wave therapy (ESWT) on eukaryotic tissues, only little data are available concerning their effect on prokaryotic microorganisms. The objective of the present study was to determine the bactericidal activity as a function of energy flux density and shock-wave impulse number. Standardised suspensions of *Staphylococcus aureus* ATCC 25923 were exposed to different impulse numbers of shock waves with an energy flux density (ED) up to 0.96 mJ mm^{-2} (2 Hz). Subsequently, viable bacteria were quantified by culture and compared with an untreated control. After applying 4000 impulses, a significant bactericidal effect was observed with a threshold ED of 0.59 mJ mm^{-2} ($p < 0 \cdot 05$). A threshold impulse number of more than 1000 impulses was necessary to reduce bacterial growth ($p < 0 \cdot 05$). Further elevation of energy and impulse number exponentially increased bacterial killing. ESWT proved to exert significant antibacterial effect in an energy-dependent manner. Certain types of difficult-to-treat infections could offer new applications for ESWT. (E-mail: Gerdesmeyer@aol.com) © 2005 World Federation for Ultrasound in Medicine & Biology.

Key Words: **Infection, Lithotripsy, Shock wave, ESWT, Bactericidal, Antibacterial, Energy flux density, Impulse number.**

INTRODUCTION

Since the introduction of extracorporeal shock-wave therapy (ESWT) for the treatment of nephrolithiasis by Chaussy et al. (1980), a multitude of new indications for ESWT have arisen. Nowadays, extracorporeal shock waves are not only applied for the treatment of kidney stones, but also for the fragmentation of gallstones, pancreas stones and salivary gland stones (Delhaye et al. 1992; Iro et al. 1992; Sauerbruch et al. 1986). Apart from physical disintegration of calculi as an approved standard therapy in humans, enthesiopathies like tennis elbow, plantar heel spur or calcified tendonitis of the shoulder and bone pathologies (pseudarthroses and delayed unions) represent classical indications for ESWT (Dahmen et al. 1993; Gerdesmeyer et al. 2003; Kaulesar Sukul et al. 1993; Rompe et al. 1996a, 1996b; Schleberger and Senge 1992).

However, despite considerable knowledge about effects of shock waves on eukaryotic soft tissues, only few data are available concerning their effect on prokaryotic microorganisms. In a first approach, we evaluated the direct effect of extracorporeal shock waves on staphylococci *in vitro*. These results indicated a highly significant bactericidal effect of extracorporeal shock waves on viable *Staphylococcus aureus* cells with a mean decrease by a factor of approximately 1.3×10^3 or 3.1 orders of magnitude (von Eiff et al. 2000). Moreover, a significant bactericidal effect of high energy shock waves was found for different gram-positive and gram-negative pathogens such as *Staphylococcus epidermidis*, *Enterococcus faecium* and *Pseudomonas aeruginosa* (Gollwitzer et al. 2004).

In this study, we evaluated the bactericidal activity as a function of energy flux density (ED) and shock-wave impulse number (IN) to define the optimal *in vivo* conditions. An appropriate animal infection model is now warranted to further evaluate the data defined in these experiments. Our results may provide the basis of novel treatment for certain types of bacterial infections.

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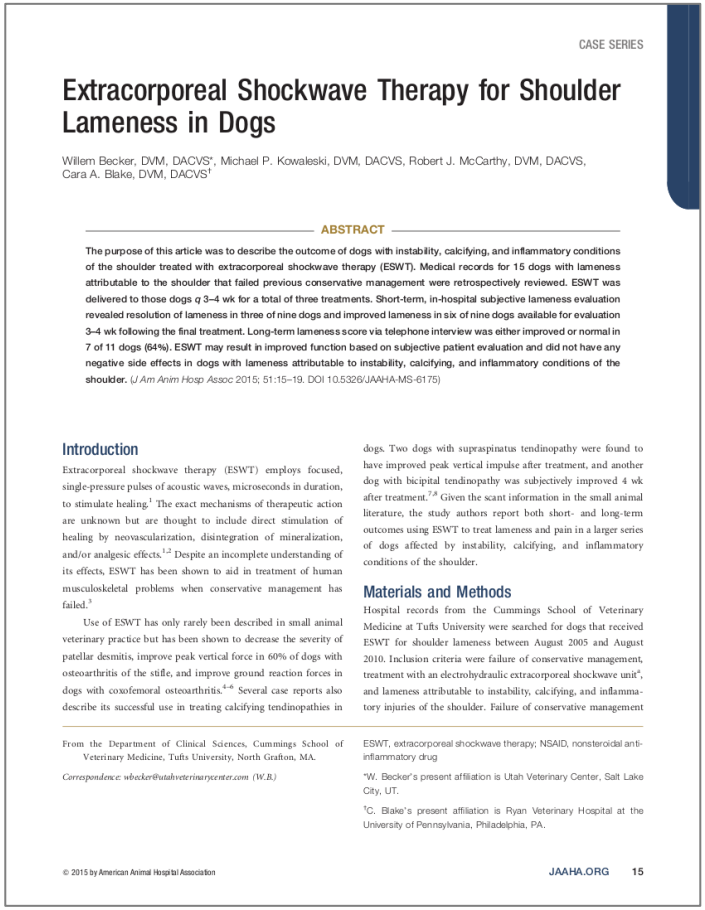
КЛИНИЧЕСКИЕ ДАННЫЕ

EXTRACORPOREAL SHOCKWAVE THERAPY FOR SHOULDER LAMENESS IN DOGS

Authors: Willem becker, DVM, DACVS, Michael P. Kowaleski, DVM, DACVS, Robert J. Mccarthy, DVM, DACVS, Cara A. Blake, DVM, DACVS

Source: Q 2015 by American Animal Hospital Association



CASE SERIES

Extracorporeal Shockwave Therapy for Shoulder Lameness in Dogs

Willem Becker, DVM, DACVS*, Michael P. Kowaleski, DVM, DACVS, Robert J. McCarthy, DVM, DACVS, Cara A. Blake, DVM, DACVS†

ABSTRACT

The purpose of this article was to describe the outcome of dogs with instability, calcifying, and inflammatory conditions of the shoulder treated with extracorporeal shockwave therapy (ESWT). Medical records for 15 dogs with lameness attributable to the shoulder that failed previous conservative management were retrospectively reviewed. ESWT was delivered to those dogs *q* 3–4 wk for a total of three treatments. Short-term, in-hospital subjective lameness evaluation revealed resolution of lameness in three of nine dogs and improved lameness in six of nine dogs available for evaluation 3–4 wk following the final treatment. Long-term lameness score via telephone interview was either improved or normal in 7 of 11 dogs (64%). ESWT may result in improved function based on subjective patient evaluation and did not have any negative side effects in dogs with lameness attributable to instability, calcifying, and inflammatory conditions of the shoulder. (*J Am Anim Hosp Assoc* 2015; 51:15–19. DOI 10.5326/JAAHA-MS-6175)

Introduction

Extracorporeal shockwave therapy (ESWT) employs focused, single-pressure pulses of acoustic waves, microseconds in duration, to stimulate healing.[1] The exact mechanisms of therapeutic action are unknown but are thought to include direct stimulation of healing by neovascularization, disintegration of mineralization, and/or analgesic effects.[1,2] Despite an incomplete understanding of its effects, ESWT has been shown to aid in treatment of human musculoskeletal problems when conservative management has failed.[3]

Use of ESWT has only rarely been described in small animal veterinary practice but has been shown to decrease the severity of patellar desmitis, improve peak vertical force in 60% of dogs with osteoarthritis of the stifle, and improve ground reaction forces in dogs with coxofemoral osteoarthritis.[4–6] Several case reports also describe its successful use in treating calcifying tendinopathies in dogs. Two dogs with supraspinatus tendinopathy were found to have improved peak vertical impulse after treatment, and another dog with bicipital tendinopathy was subjectively improved 4 wk after treatment.[7,8] Given the scant information in the small animal literature, the study authors report both short- and long-term outcomes using ESWT to treat lameness and pain in a larger series of dogs affected by instability, calcifying, and inflammatory conditions of the shoulder.

Materials and Methods

Hospital records from the Cummings School of Veterinary Medicine at Tufts University were searched for dogs that received ESWT for shoulder lameness between August 2005 and August 2010. Inclusion criteria were failure of conservative management, treatment with an electrohydraulic extracorporeal shockwave unit[a], and lameness attributable to instability, calcifying, and inflammatory injuries of the shoulder. Failure of conservative management

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ESWT, extracorporeal shockwave therapy; NSAID, nonsteroidal anti-inflammatory drug

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КЛИНИЧЕСКИЕ ДАННЫЕ

EFFECTS OF RADIAL SHOCKWAVE THERAPY ON THE LIMB FUNCTION OF DOGS WITH HIP OSTEOARTHRITIS

Authors: M. Mueller, B. Bockstahler, M. Skalicky, E. Mlacnik, D. Lorinson

Source: Veterinary Record (2007) 160, 762-765

Effects of radial shockwave therapy on the limb function of dogs with hip osteoarthritis

M. MUELLER, B. BOCKSTAHLER, M. SKALICKY, E. MLACNIK, D. LORINSON

The objective of this study was to evaluate the effects of extracorporeal radial shock wave therapy on the hindlimb function of dogs suffering from hip osteoarthritis. Twenty-four client-owned dogs with hip osteoarthritis were investigated; 18 of them received radial shockwave therapy and six were left untreated as controls. Force plate analysis on a treadmill was used to assess the dogs' hindlimb function before treatment and four weeks after the last treatment, and the treated dogs were re-evaluated three and six months after the treatment. The parameters chosen for evaluation were peak vertical force and vertical impulse, and the calculated symmetry indices. In the treated dogs, differences between the ground reaction forces exerted by the right and left hindlegs disappeared four weeks after the treatment, whereas in the control dogs only the peak vertical force distribution changed significantly. The significant improvement in the treated dogs was confirmed by changes in the symmetry indices. Significant improvements in vertical impulse and peak vertical force were observed three months after the treatment.

EXTRACORPOREAL radial shockwave therapy is a common treatment in human medicine for various orthopaedic disorders, such as epicondylitis lateralis humeri, tendinosis calcarea or fasciitis plantaris (Heller and Niethard 1998). Recently, several studies have been performed to evaluate the effectiveness of the treatment, but the results have ranged from beneficial (Theodore and others 2004) to negligible (Chung and Wiley 2004).

Two different types of shockwaves can be used for the treatment of orthopaedic disorders – focused and radial shockwaves. Focused shockwaves reach their highest energy density in the depths of the tissue whereas radial shockwaves decrease in energy in proportion to the square of the distance from the surface (McClure and Merrit 2003).

In horses, shockwaves are mostly used for the treatment of tendon problems; horses suffering from proximal suspensory desmitis or osteoarthritis of the tarsometatarsal and distal intertarsal joints benefit from extracorporeal shockwave therapy (McCaroll and McClure 2000, Crowe and others 2004). Shockwave therapy has been used in dogs for some years but few studies have recorded the outcome of the treatment. Adamson and Taylor (2003) reported its effect in various orthopaedic conditions in 10 dogs, and Danova and Muir (2003) described the treatment of supraspinatus calcifying tendinopathy in two dogs. The results of these studies were evaluated by clinical examination and questions to the owners. The second study also used force plate analyses with peak vertical force as an evaluation parameter. Other studies suggesting that shockwave therapy had positive effects on the clinical signs of osteoarthritis in dogs have been described by Francis and others (2004) and Dahlberg and others (2005).

In this study 18 dogs with hip osteoarthritis were treated with a radial shockwave system.

It was hypothesised that there would be positive effects of the radial shockwave therapy on the ground reaction forces within a month of the last treatment, in comparison with the results in six untreated control dogs. Significant differences between the results for the two hindlegs were expected before the treatment began, and a redistribution of force between the hindlegs was expected during the evaluation period.

MATERIALS AND METHODS

Twenty-four client-owned dogs of different breeds with a history and clinical signs of hip osteoarthritis, diagnosed on the basis of orthopaedic and radiographic examinations, were used; 18 of them were treated and six were left untreated as controls. The treated group ranged in age from two to 12 years (mean [sd] 6·8 [3·0] years) and weighed from 18·2 to 57 kg (mean 34·2 [10·0] kg); nine of them were male and nine female. The untreated group ranged in age from three to nine years (mean 5·3 [2·4] years) and weighed from 32·6 to 47·9 kg (mean 38·4 [5·3] kg); four of them were female and two male.

The treated dogs were treated with a Swiss DolorClast Vet (Electro Medical Systems). Before the treatment the hair in the lateral region of the hip joint was clipped, and contact gel was applied; 2000 shots with a pressure of 2 bars and a frequency of 15 Hz were applied three times with a week between the treatments. Both hips were treated, except in the dogs that had unilateral clinical signs. The control dogs were not treated in any way for seven days before the start of the study or during the evaluation period.

Four biomechanical force sensors (Type 9011 A; Kistler Instruments) mounted into a treadmill specifically developed for use in small animals were used for data collection. The rectangular platforms were 25 cm × 50 cm and contained the four piezoelectric sensors for the measurement of vertical ground reaction forces (GRF), one on each corner.

The GRFs of the dogs in both groups were measured before the treatments began (T0) and four weeks after the last treatment; 16 of the treated dogs were re-evaluated three months after the last treatment and 13 were re-evaluated after six months.

The dogs were not trained on the treadmill before the measurements, during which they were allowed to walk at a comfortable speed. The velocity of the treadmill ranged from 1·06 to 1·22 m/second (mean 1·19 [0·05] m/second). The GRF was measured at 300 Hz and analysed by using software (SIMI Motion Version 6.5; SIMI Reality Motion Systems). For the evaluation, five valid steps of the hindlimbs were chosen; a step was 'valid', when the four force plates had been hit by their corresponding limbs.

The parameters of the GRFs chosen were peak vertical force (PFz) and vertical impulse (IFz) of the hindlimbs. All the measurements were normalised with respect to the dog's bodyweight and expressed as a percentage of bodyweight as described by Roush and McLaughlin (1994) and McLaughlin and Roush (1995). The values of PFz and IFz were averaged over five valid steps of each trial.

At the outset of the study the values of PFz and IFz were categorised according to the affected body side (better or worse), and the measurements were labelled accordingly: PFzB and IFzB for the more weight-bearing limb and PFzW

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КЛИНИЧЕСКИЕ ДАННЫЕ

EXTRACORPOREAL SHOCKWAVE THERAPY IN A DOG WITH CHRONIC BICIPITAL TENOSYNOVITIS

Authors: C.Venzin, S.Ohlerth, D. Koch, D. Spreng

Source: Stosswellentherapie beim Hund

Originalarbeit

Extracorporeal shockwave therapy in a dog with chronic bicipital tenosynovitis

C.Venzin[1], S.Ohlerth[2], D. Koch[3], D. Spreng[1]

[1]Division of Small Animal Surgery and [2]Division of Diagnostic Imaging and Radio-Oncology, University of Berne, [3]Division of Small Animal Surgery, University of Zurich

Summary

A 15-month-old, spayed female, Bernese mountain dog was presented to the Institute of Small Animal Surgery at the University of Zurich because of chronic left forelimb lameness. The referring veterinarian diagnosed pain in the left shoulder region and had treated the dog with systemic non-steroidal anti-inflammatory drugs and restricted exercise for a two-week period. The follow-up examination revealed only minimal improvement and therefore, the dog was referred for further diagnostic evaluation. Chronic bicipital tenosynovitis and tendinitis of the infraspinatus muscle was diagnosed based on survey radiographs, arthrography, ultrasound, computed tomography (CT), and synovial fluid cytology. The dog underwent three sessions of extracorporeal shockwave therapy and substantial clinical improvement was observed. On follow-up examinations, only mild left forelimb lameness was evident following exercise, and changes in the intertubercular groove and at the supraglenoid tuberosity appeared less active on radiographs and CT. However, six months following treatment, mild degenerative joint disease was apparent.

Key words: Bernese mountain dog, bicipital tenosynovitis and tendonitis of the infraspinatus muscle, shockwaves, CT

Extrakorporale Stosswellentherapie bei einem Hund mit chronischer Sehnenscheidenentzündung

Eine 15 Monate alte weiblich-kastrierte Bernersennenhündin wurde wegen chronisch progressiver Lahmheit im Tierspital Zürich vorgestellt. Der Privattierarzt diagnostizierte Schmerz in der linken Schulterregion und hatte den Hund mit nicht steroidalen Entzündungshemmern und Bewegungseinschränkung während 2 Wochen vorbehandelt. Diese Behandlung zeigte nur minimale Besserung, darum wurde der Hund für weitere Abklärungen überwiesen. Eine chronische Sehnenscheidenentzündung des M. biceps brachii und des M. infraspinatus wurde mittels Röntgennativaufnahme, Arthrographie, Ultraschall, Computertomographie (CT) und Zytologie der Synovialflüssigkeit diagnostiziert. Der Hund wurde mit drei extrakorporalen Stosswellensessionen behandelt und zeigte daraufhin klinisch eine deutliche Besserung. Bei der Nachuntersuchung zeigte der Hund nur noch eine geringe Lahmheit in der vorderen linken Gliedmasse und die Veränderungen im Schultergelenk waren auf dem Kontrollröntgen und dem Kontroll-CT weniger aktiv. Sechs Monate nach Behandlung waren trotzdem geringe degenerative Gelenksveränderungen sichtbar.

Schlüsselwörter: Bernersennenhund, Sehnenscheidenentzündung, M. biceps brachii und M. infraspinatus, Stosswellen, Computertomographie

Case presentation

A 15-month-old, spayed female Bernese mountain dog was presented to the Clinic of Small Animal Surgery at the University of Zurich with a history of progressive lameness over several weeks. The referring veterinarian noted severe, grade 3 out of 4, lameness in the left forelimb, localized to the region of the shoulder joint. Radiographs of the shoulder joints taken by the referring veterinarian demonstrated bilateral mineralised periarticular structures, which were more pronounced on the left side. The dog was treated with carprofen (Rimadyl®, Pfizer) 4 mg/kg/d for two weeks and the owner was advised to restrict the dog to leash walks. No substantial improvement in the degree of lameness was observed in this short time of treatment for a chronic lameness and the client was then referred.

At presentation, the general physical examination was unremarkable. The orthopaedic examination revealed

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КЛИНИЧЕСКИЕ ДАННЫЕ

EXTRAKORPORALE STOSSWELLENTHERAPIE IN DER VETERINADRMEDIZIN

Authors: M.Schnewlin, C. Lischer

Source: Stosswellentherapie beim Hund

Übersichtsarbeit

Extrakorporale Stosswellentherapie in der Veterinärmedizin

M. Schnewlin, C. Lischer

Veterinär-Chirurgische Klinik der Universität Zürich

Zusammenfassung

Diese Übersichtsarbeit soll einen Einblick in eine neue Therapieform im Bereich der Pferde-Orthopädie verschaffen. In der Humanmedizin wird die extrakorporale Stosswellentherapie zur Lithotripsie von Nierensteinen und in der Orthopädie eingesetzt. In der Pferdemedizin kommt sie fast ausschliesslich bei Problemen am Bewegungsapparat zur Anwendung. Zu den Hauptindikationen zählen Insertionstendinopathien des M. interosseus medius, Sehnen- und Bandläsionen, osteoporotische Veränderungen sowie Spat. Die Wirkungsweise der Stosswellen, und die verschiedenen Stosswellengeräte für die Anwendung in der Pferdeorthopädie werden besprochen. Zudem wird auf eine Studie, die zur Zeit am Tierspital Zürich durchgeführt wird, eingegangen.

Schlüsselwörter: Stosswellentherapie – Stosswellengeräte – Wirkungsweise – Indikationen – Pferd

Extracorporal shock wave therapy in veterinary medicine

This article gives a general overview on a new therapy in equine orthopedics. In human medicine extracorporal shock wave therapy (ESWT) is used for lithotripsy of stones of the urologic system and also in orthopedics. In equine medicine the therapy is almost exclusively applied for the treatment of orthopedic problems. The main indications are proximal suspensory desmitis (PSD), lesions of tendons and ligaments, osteoporotic changes and spavin. In this paper the mode of action of shock waves and the different shock wave devices are discussed. Also, some information about an ongoing clinical trial at the Animal Hospital University of Zürich is given.

Key words: shock wave therapy – shock wave machines – mode of action – indications – horse

Einleitung

Die extrakorporale Stosswellentherapie (ESWT) ist in der Humanmedizin ursprünglich für die Zerstörung von Nierensteinen entwickelt worden. Vor rund zehn Jahren wurde dann begonnen, diese Technik auch bei orthopädischen Problemen (Tennis-Ellbogen, Fersensporn, Pseudarthrosen) einzusetzen.

Seit einiger Zeit wird diese Therapieform zunehmend auch in der Pferdemedizin für die Behandlung von chronischen Lahmheiten angewendet.

Vorliegende Arbeit soll einen Einblick in die physikalischen Grundlagen und die Wirkungsweise der Stosswellentherapie verschaffen. Zudem soll ein Überblick über die verschiedenen aktuellen Stosswellengeräte und die Indikationen bei Mensch und Pferd gegeben werden.

Physikalische Grundlagen

Was sind Stosswellen?

In der Physik wird eine Stosswelle definiert als starke Druckwelle, die in elastischen Medien wie Gasen, Flüssigkeiten oder festen Körpern durch Explosionen, Blitze, Überschallflugzeuge oder andere Phänomene, die extreme Druckänderungen hervorrufen, erzeugt wird. Stosswellen unterscheiden sich von Schallwellen – z. B. Ultraschallwellen – dadurch, dass in der Wellenfront mechanische Spannungen und Drucke sehr hohe Werte annehmen. Ein kennzeichnendes Merkmal einer Stosswelle besteht darin, dass sie sich mit Überschallgeschwindigkeit ausbreitet und ihre Geschwindigkeit mit wachsender Amplitude sogar zunimmt, wohin-

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Intensity gradient mode	•	•	
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Encyclopaedia	•	•	
Encyclopaedia with anatomical images	•	•	
User-defined protocols	100	100	
Dimensions	320 × 190 × 280 mm		
Weight: main unit (without accessories)	7 kg		
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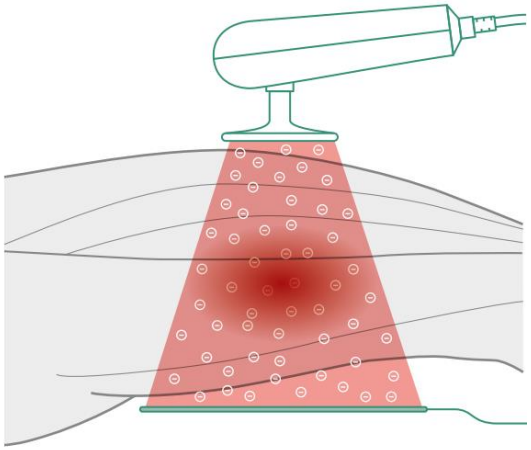

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