LOW LEVEL LASER THERAPY FOR PHYSICAL THERAPISTS

SECOND EDITION

By MALINI CHAUDHRI. Ph.D, L.Ac (WHO. China). ISTE
Edited by JAN TUNER, DDS. SWEDEN

CENTER FOR WELLNESS. ISTE
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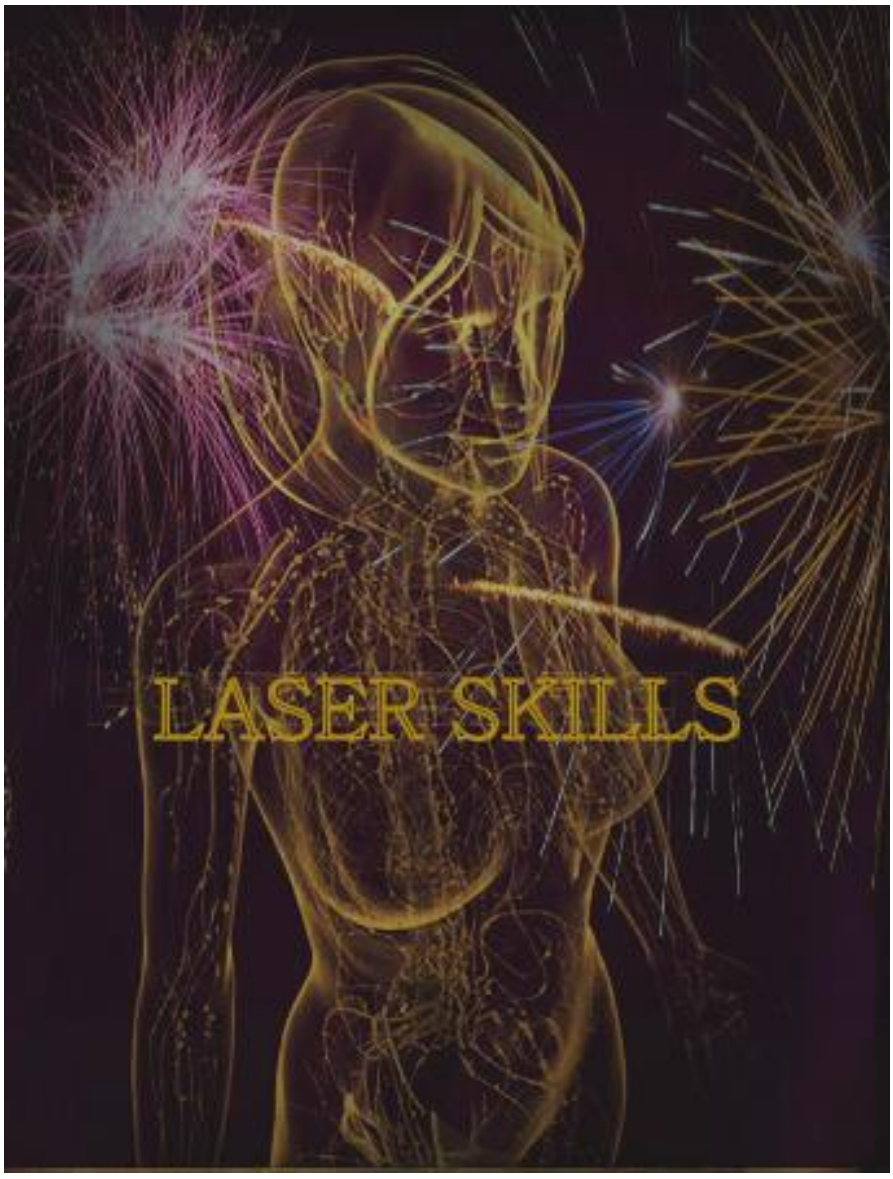
Low Level Laser Therapy for Physical Therapists, Second Edition


LASER SKILLS

SKILLS DEVELOPMENT IN LOW LEVEL LASER APPLICATIONS FOR OPTIMUM AND PAINLESS RECOVERY

This manual is developed towards a practical online course for physiotherapists and doctors seeking to enhance their skills.

The course manages supplements, guidelines for portfolio of practical's, and assessments on the first five sections.

The science is very vast in its discovery and potential. This manual is restricted to technical structures of application in relation to manual therapies, physical therapy, cam or medi-spa, and has rich sources of evidence which will support all medical practitioners.

The sections reveal interesting approaches to integrated therapy with laser that enhances effects and reduces recovery downtime.

Most interesting is that low level laser heals the DNA, which has great potential in gene support and many new possibilities for healing.

ABOUT THE AUTHOR

Malini Chaudhri was born in Calcutta, India, in 1963. She attended university in Mumbai, and then travelled in 1987 to China where she settled as a Foreign Expert in South China Normal University to teach English to Undergraduates. By 1989 she was promoted to the English Graduate department in the University.

She developed an interest in Chinese medicine, especially laser acupuncture, which was a new modality in 1990. She interacted with experts over seminars in Hong Kong, Taiwan and China.

In 1994, back in Delhi, she was laser consultant to the National Hockey team and Sports Authority of India. Hinduja Sports Foundation awarded her a meritorious grant to cover her Ph.D. fees in Alma Ata University in Sri Lanka. In 2002 she was given a W.H.O (China) International license by Alma Ata which permitted her to practice traditional acupuncture outside of China.

The Low Level Laser Therapy system was fast emerging as a specialized science. Laser acupuncture was far from understood. The author met with the leading team of laser scientists in Chennai at the ISLSM meet. In 2002 She travelled to Tsukuba to attend the 4th WALT World Congress and presented a trial on National Women's golf. An editorial appeared in Laser World which showed laser acupuncture as a modality that could give relief to golfers during times of harsh weather. Premsyl Fryda published two scientific papers authored by Malini Chaudhri in Laser Partner Journal, published by the Czech Republic.

In 2003 she was invited through personal sponsorship to the U.S. She attended the NAALT Congress at Bethesda and attended professional development courses in the US in Lymphology, Sports massage and Medical Acupuncture.

After 2004 the author was actively involved with application in sports as horse Polo, and golf. She was consultant to many celebrated international sports persons. For some time she assisted a neurosurgeon with laser. The Spa industry came up by 2007, and the author took a lead role in developing world class spas in Heritage hotels and Indian Palaces of living monarchs. In 2008 she managed the verification of the Habia qualification in India which was successfully verified by the UK team. Soon after she became a life member of Indian Society of Technical Education, and developed the Center for Wellness as a Skills Knowledge Provider in the wellness industry, based on MOU. She integrated with CAM sector in hospitals and provided research on orthopaedic management, tendonitis and stroke rehabilitation. She managed CME seminars for hospitals which was appreciated.

WITH KIND COURTESY VALUABLE EDITORIAL CONTRIBUTIONS ARE FROM JAN TUNÉR

A vote of thanks to Jan Tunér for his support, time, and rich knowledge in this subject which has been shared with me in full LLLT has emerged during the past two decades with infinite possibilities. Jan Tuner has made a lot of this possible by establishing the scientific doctrine through his book, co-authored with Lars Hode, through his appointments as newsletter editor and Secretary General of WALT, and through his editorial management of Laser World, and his activities with Swedish Medical Laser Society.

Jan Tunér has supported India with his book donated to me for the development of laser knowledge in India and remained consistently, a profound scientific mentor to me and the laser scientist fraternity. In this course, we are proud recipients of his grace and editorial advice which has upgraded out text into a new generation model of knowledge awareness. LLLT may possibly become the future of medicine.

Publications by Jan Tunér, DDS. Detailed reference to meritorious scientific publications are listed at the end of the manual.
Jan Tunér: General Manager, Prima Books AB, Sweden. President, Dala Dental. Sweden.

Publications : BOOKS

Tunér J, Hode L. Dental laser be handling. 1992. Svenska Laser-Medicinska Sällskapet, Stockholm.
Tunér J, Hode L. Lågeffekts laser i odontologin. 1995. Svenska Laser-Medicinska Sällskapet.
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Jan Tunér, Per Hugo Kristensen. Low Level Lasers in Dentistry. In: Convissar B (ed).

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Editorial board member of the Journal “Laser Therapy” 1996-2001.
Editorial board member of “Photo medicine and Laser Surgery” 2002 - Present
Editor in chief, WALT Review 2000 – Present
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Reviewer of Photo medicine and Laser Surgery
Reviewer of Lasers in Medical Science
Reviewer of Angle Orthodontics
Reviewer of Lasers in Surgery and Medicine
Reviewer of Current Rheumatology
Reviewer of Journal of Photochemistry & Photobiology B: Biology
Reviewer Medical Science Monitor 2010Senior editor of Laser, International magazine of Laser Dentistry 2009 – present

Continued at back of book

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We are proud recipients of their mandate.
Special thanks to Dr. Professor Ranjit Singh, former Secretary, ISTE and Editor of ISTE Journal.

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The author is associated with many Laser Scientific groups as ISLA, WALT, NAALT, ISLMS and EMLA. A senior member of EMLA has awarded her certificates of merit based on journal IP no ISSN 1213-3027, 1213-1156, the Journal being named Laser Partner from Czech Republic.

The author is US licensed in Sports massage, Lymphatic Drainage therapy, and Medical Acupuncture of Nogier. She is certified to use German laser physio of Weberneedles.

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CONTENTS

Interspersed with editorial updates

Continued profile of Jan Tuner

PREFACE TO THE SECTIONS

This manual is for Skills development in therapists needing to upgrade from manual therapy to low level laser therapy. It will support practical training in fitness therapists, physical therapists, CAM therapists and advanced spa therapists. It will also support patients who need to know or asses their therapist's skills in order to achieve the most of their treatment regimen.

LLLT does not come with cook book formulas, so be receptive to the experience of the particular therapist.

The first section is an introduction to LLLT with precise support to its basic background and development in clinical practise. Jan Tuner has offered valuable inputs on the directions of the new treatment modality in its scope for reversing serious disease or managing conditions.

The second section discusses many aspects of safety in practise. This is so that mistakes can be circumvented that cause the business, laser or scientific arena to be mistrusted.

The third section is applicable to the muscle anatomy and approaches to accelerate healing time. The techniques come under myofascial dysfunction.

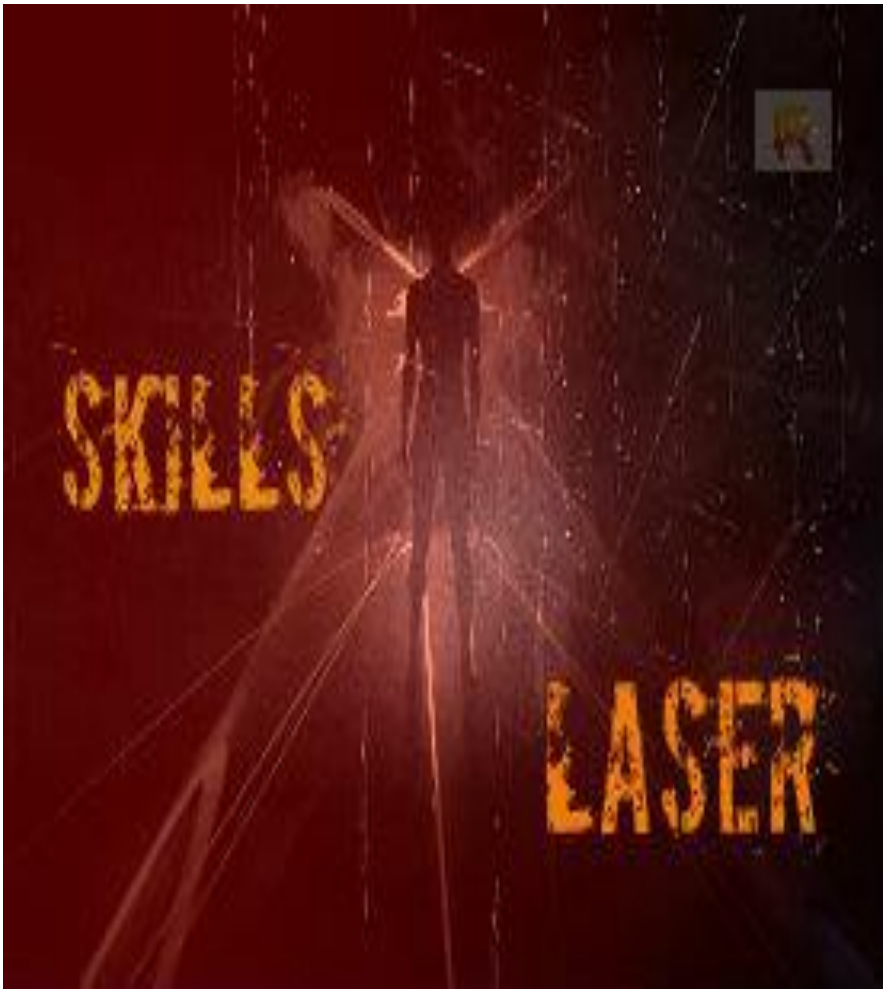
The fourth section is based on lymphatic drainage and reconstruction and the impact of the science on managing lymphedema, cancer prevention and post-surgical clinical support.

The fifth section is based on laser acupuncture and frequencies used for various concerns that are mental, psychological, and emotional or even limbic (primitive). Micro acupuncture is also discussed which is known for de-addiction, weight loss, metabolic syndrome, sedation, anaesthesia and similar.

The final session reviews recent clinical data on intravenous laser, which treats systemic diseases based on blood and circulatory problems.

SECTION ONE

LLLT IN SKILLS DEVELOPMENT



LASERS IN SCIENTIFIC PRACTISE
THE NATURE OF LOW LEVEL LASER THERAPY IN HEALING
PRACTICAL KNOWLEDGE

SKILLS DEVELOPMENT IN THIS SECTION

KNOWLEDGE OF LASER SPECIFICATIONS AND MECHANISMS
PRINCIPLES OF APPLICATION
WALT DOSE RECOMMENDATIONS
EDITORIAL CONTRIBUTIONS. New generation laser therapy
FOUNDATIONS OF PRACTISE

CONTENTS

KNOW YOUR LASER : COMMON PARAMETERS

Helium Neon 630-685 nm, In Ga AIP red laser light
780 – 830 nm, Ga AlAs slightly visible red laser light
904 nm, Ga As super pulsed. Invisible laser light
10.600 nm.CO2 laser. Invisible light

When using a therapeutic laser in vivo, we need to consider many additional parameters. If most of the laser light is absorbed in the dermis, for example, then we cannot achieve an optimal effect. When laser light hits tissue, it can be absorbed, scattered (including reflection), or transmitted. The main components in tissue that we need to consider are: melanin, oxyhaemoglobin, deoxyhemoglobin, and water. We can get light into the body with wavelengths from 600 nm (red end of the spectrum) to 1100 nm (near infrared end of the spectrum). The range is often referred to as the "therapeutic window" for laser applications.

Although these wavelengths can penetrate, each wavelength has unique penetration characteristics. If we put an ordinary white light source, a flashlight, into the palm of our hand, we will see a red glow out the other side. Longer wavelengths such as red penetrate deeper.
The amount of red light visibly seen through the hand is dependent on the colour of the skin. Melanin absorbs light strongly, so dark skin will absorb more light, especially wavelengths from 500 nm to 800 nm. Wavelengths longer than 1200 nm absorb in water very strongly and therefore it is difficult to get much penetration in tissue. These longer wavelength lasers are typically used in ablative procedures such as surgery or skin resurfacing.

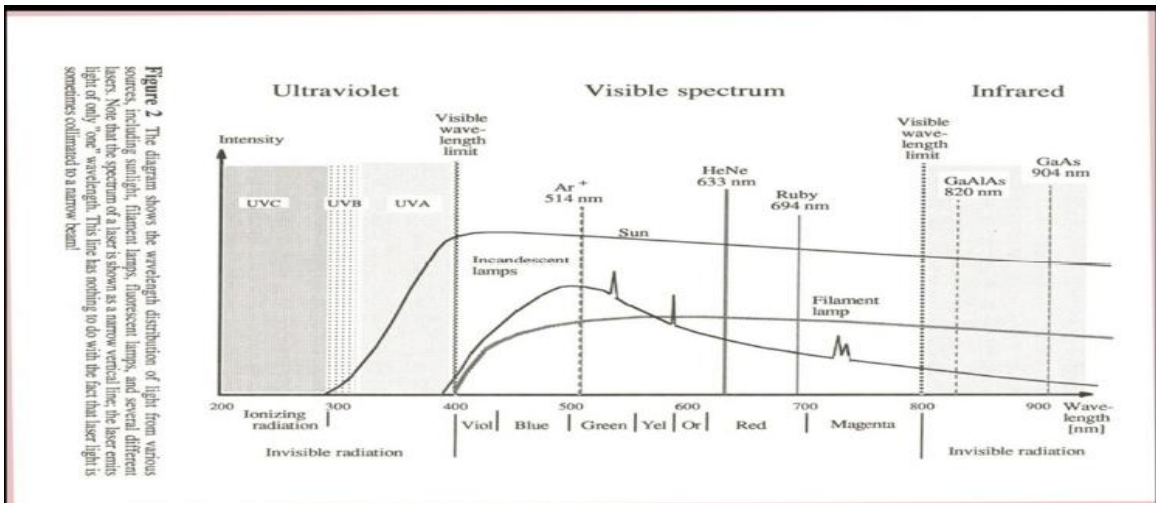


Figure 2 The diagram shows the wavelength distribution of light from various sources, including sunlight, filament lamps, fluorescent lamps, and several different lasers. Note that the spectrum of a laser is shown as a narrow vertical line; the laser emits light of only "one" wavelength. This line has nothing to do with the fact that laser light is sometimes collimated to a narrow beam!

Courtesy Jan Tuner.

ACTION SPECTRUM

Editorial selection on recent literature

Karu recalls the basic LAWS OF PHOTOCHEMISTRY
The first law of photochemistry (Grotthus-Draper Law) states that a molecule before photochemistry must absorb light. LLLT is concerned with the photo acceptor.

The second law of photochemistry (Stark-Einstein law) states that light absorbed need not necessarily result in photochemistry, but if it does, only one photon is required for each affected molecule. This indicates a relatively short life span of an electronically excited molecule and the relatively low concentration of incident photons in most conventional systems.
Photons carry a level of energy that depend on their wavelength and this wavelength can be transferred into a molecular entity by absorption.
The absorption spectrum is the spectrum of radiant energy whose intensity at each wavelengths a measure of the amount of the amount of energy at that wavelength that has passed through a selectively absorbing substance.
The action spectrum, means the efficiency with which electromagnetic radiation produces a photochemical reaction.

ACTION SPECTRA

The radiation wavelengths effective for photobiology range between 300 and 900 nm, i.e., from UV (ultraviolet) to near IR (infrared). Practically all photo biological processes in plants and animals, such as photosynthesis,

phototropism, photo taxis, photo periodism, and vision, utilize this range of radiation. The photoreceptor molecules responsible for these photo responses have well studied for decades.

The regulation of cellular metabolism by visible light is not a classical topic of photobiology.

Only the finding of the existence of action spectra in the region from 330 to 860 nm for the increase of DNA and RNA synthesis rates in mammalian cells, as well as for growth stimulation of eukaryotic and prokaryotic microorganisms recorded in the 1980's, indicated that monochromatic light in the visible-to-near visible region can be a subtle instrument to regulate cellular metabolism. This finding means that the topic of low level laser phototherapy. (or low level light therapy, or laser bio stimulation) belongs to photobiology.

An action spectrum is a plot of the relative effectiveness of different wavelengths of light in causing a particular biological response, and under ideal conditions, it should mimic the absorption spectrum of the molecule that is absorbing the light, and whose photochemical alteration causes the effect.

The action spectra in the visible-to-near IR region for the biological responses of cultured cells showed that red light at 632.8 nm was not the only wavelength suitable for laser bio stimulation.

These spectra together with the results of experiments using the dichromatic irradiation of cells, and the modification of light effects with chemicals, showed that "laser bio stimulation" is a photo biological phenomenon. These data also allowed the suggestion that the photo acceptor for the stimulation of cell metabolism is the terminal enzyme of the respiratory chain, i.e., cytochrome c oxidase for eukaryotic cells, and the cytochrome complex for Escherichia coli.

In the blue spectral region, flavo proteins like NADH-dehydrogenase can work as photo acceptors as well. The suggestion that cytochrome c oxidase is the photo acceptor molecule has been recently confirmed in elegant experiments with functionally inactivated primary neurons, proposing that light up regulates this enzyme.

2. ACTION SPECTRA for an INCREASE of DNA and RNA SYNTHESIS RATE in CULTURED MAMMALIAN CELLS

First at all, let us remember that in eukaryotic cells, DNA and RNA synthesis occur in the nucleus, which does not have chromophores absorbing in the spectral region used for laser phototherapy (600-900 nm).

the wavelength range used in our experiments, and important for phototherapy (600-860 nm), there are four "active" regions, but the peak positions are not exactly the same for all action spectra. The red band has a peak position between 613.5 and 623.5 nm (in one spectrum, at 606 nm); the far-red band has peak positions between 667.5 and 683.7 nm, and two near IR bands in the range of 750.7-772.3 nm and 812.5-846.0 nm.

3. INTERPRETATION of the ACTION SPECTRA: CYTOCHROME C OXIDASE is the PHOTOACCEPTOR MOLECULE

In the beginning of the 90's, the earlier action spectra were analysed using all available spectroscopic literature data which allowed forming a suggestion about the chromophores involved. Bear in mind that the chromophores are the components of molecules that absorb the light.

A number of other kinds of experiments (dose and intensity dependences for various wavelengths, dichromatic irradiation in various ways modification of irradiation experiments by specific chemicals, and others) were performed. The results of all these experiments, together with action spectroscopy experiments, allowed the conclusion that cytochrome c oxidase could be a universal photo acceptor for eukaryotic

cells.

4. **COMPARISON of ACTION and ABSORPTION SPECTRA**

Insofar as an action spectrum mirrors the absorption spectrum of the molecule that absorbs the light and is responsible for the action spectrum recorded, an important step in identification of this photo absorbing molecule is the comparison of action and absorption spectra.
The comparison of action spectra connected with reactions in the cellular nucleus, and the absorption spectra of cellular monolayers at 600-860 nm allow one to conclude that by peak positions, these two groups of spectra may belong to the same molecule.

5. MITOCHONDRIAL SIGNALING: HOW the LIGHT-GENERATED SIGNAL in MITOCHONDRIA can INFLUENCE CELLULAR METABOLISM

We know from the action spectra that the DNA and RNA synthesis rate is influenced by irradiation, and we know that the photo acceptor (tentatively cytochrome c oxidase) is located in mitochondria. There is an important question left: how the signal generated by the light quanta in cytochrome c oxidase is transduced to the nucleus. The answer is that mitochondrial retrograde signalling quite probable is responsible for this.

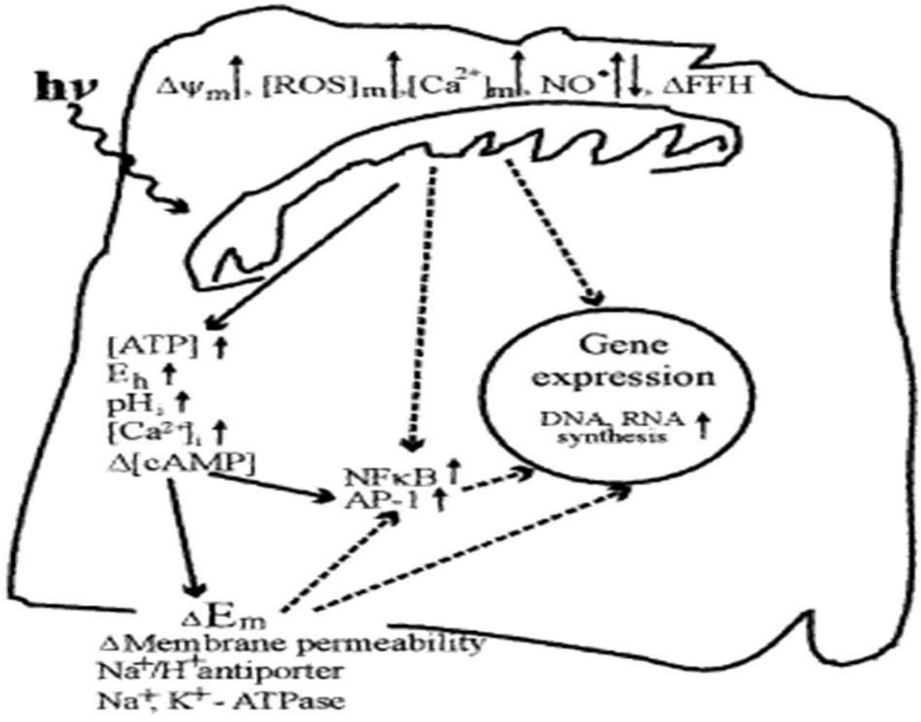
Recent work has uncovered an impressive number of extra mitochondrial factors that regulate the expression of nuclear genes for mitochondrial proteins. However, relatively little is known about how mitochondria send signals to the nucleus, and how the nucleus controls the expression of individual genes. One pathway of communication in cells from mitochondria to the nucleus that influences many cellular activities under both normal and pathophysiological conditions is mitochondrial retrograde signalling. This recently discovered signalling is an opposite signalling pathway to a common and well defined pathway transforming information from the nucleus and cytoplasm to the mitochondria. Mitochondrial retrograde signalling sends information back to the nucleus about changes in the functional state of the mitochondria.

The existence of a cellular signalling pathway: mitochondria cytoplasm (plasma membrane cytoplasm) nucleus, was proposed in 1988 . The reason to suggest the existence of such a cellular signalling pathway (then named

photo signal transduction and amplification chain) was simple. It appeared that the action spectra for the increase of DNA and RNA synthesis rate could be recorded when cultured cells are irradiated in the region From 300 to 860 nm. The nucleus does not have chromospheres absorbing in this region.

Secondly, the data gathered to date showed that photo acceptors are located in the respiratory chain. So, it was then logical to suppose the existence of cellular signalling cascades between organelles. In 2004, a novel mitochondrial-signalling pathway in mammalian cells activated by red and near IR radiation was discovered. It was shown by Schroeder et al that IR-A radiation (760-1440 nm), in contrast to UV radiation, elicits a retrograde signalling response in normal human skin fibroblasts.

Fig. 1.3



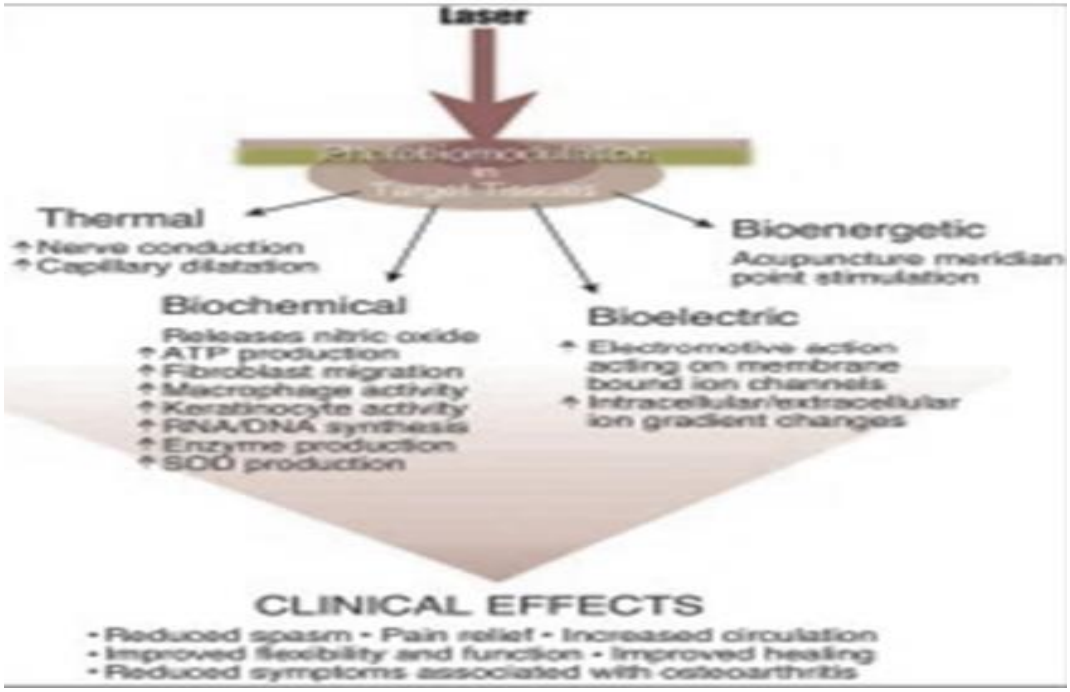
There is every reason to believe, on the basis of experimental data gathered so far, that mitochondrial retrograde signalling, a recently discovered cellular signalling pathway, functions also in irradiated cells.
Modulation of retrograde mitochondrial signalling elements like , (ROS)m, (Ca2+)m in irradiated cells is rather well documented (review: 73). Also, the responses to irradiation occurring in the nucleus (i.e., increase in DNA and RNA synthesis rate, and expression of genes of various function categories) are definitely documented. However, the pathways of light signal transduction between these two ends needs further investigation.

INFLUENCE ON INFLAMMATION

Points of high intensity laser, and areas with different levels of light intensity, experience a reaction in the permeability of cell membrane. This has effect on the Ca2+, Na+ and K+ as well as the proton gradient over the mitochondria membranes.
This phenomenon influences inflammation by increasing serotonin level in the blood, and by enhancing the S.O.D levels.

INFLUENCE ON PAIN

The primary mechanisms effects on cell membrane permeability cause a further reaction seen as increased receptor activity of cell membranes. There is an enhanced synthesis of endorphins, a decrease of Bradykinin, a decrease of c-fibre activity, and increased nerve cell action potential.
Action of low level laser induced photo bio modulation in target tissues is shown in the chart below.



1.1 MORE ON MECHANISMS OF PHOTO THERAPY

Mary Dyson has classified phototherapy and its effects on the body into primary, secondary and tertiary effects. It is the unique synergy between the three responses that create the phototherapeutic effect. The primary effects are created by direct photoreception of photons with cytochromes resulting in increases in ATP production and changes in cell membrane permeability; this response is specific to phototherapy. Photoreception is generally followed by transduction of light into cellular energy, amplification of the signal and a photo response, the last of which can be classified as either secondary or tertiary.

Secondary effects occur in the same cell in which photons produced the primary effects; they are induced by these primary effects. Secondary effects include cell proliferation, protein synthesis, degranulation, growth factor secretion myofibroblast contraction and neurotransmitter modification, depending on the cell type and its sensitivity. They are less predictable than primary effects; the sensitivity of the cells is dependent on internal and external environment factors.

The tertiary effects are the indirect responses of distant cells to changes in other cells that have interacted directly with photons. They are the least

predictable because they are dependent on both variable environmental factors and intercellular interactions. They are, however, the most clinically significant. Tertiary effects include all systemic effects of phototherapy.

1.2 CW LASERS AND SP LASERS

CW LASERS
Most lasers are **Continuous wave**, delivering direct, uninterrupted laser light Into tissue. All wavelengths are continuous.

SP LASERS(less common)
The continuity of laser light may be interrupted to form a pulse wave delivery. These lasers are **Super Pulsed** lasers. They are generally GA As lasers.
SP lasers have a lower average intensity and a single pulse of a much higher Intensity that drives photons into deeper tissue. An SP laser might have a delivery of 15 mw average interrupted by a single pulse output of 50 Watts.
A third kind of laser has a chopped pulsing. It is a crude mechanism of on/off of the laser beam. This laser is the least preferred in laser therapy practice.

Lasers come in popular DIY commercial models as laser combs laser apparatus for full body in baths and beds and even IR rooms. These have timed protocols and SOPS and induce generalized healing or photon stimulation. These apparatus must not be confused with the
targeted clinical applications applied in this manual.

INTRAVENOUS LASERS
These lasers are recent inventions for blood irradiation and anti-cancer treatment. They are used for systemic diseases based on circulatory problems. The fibre tips penetrate the vein and the laser in 5 mw or less strength, red, blue or green wavelengths, and activate blood purification and energy mechanisms deep within the body.

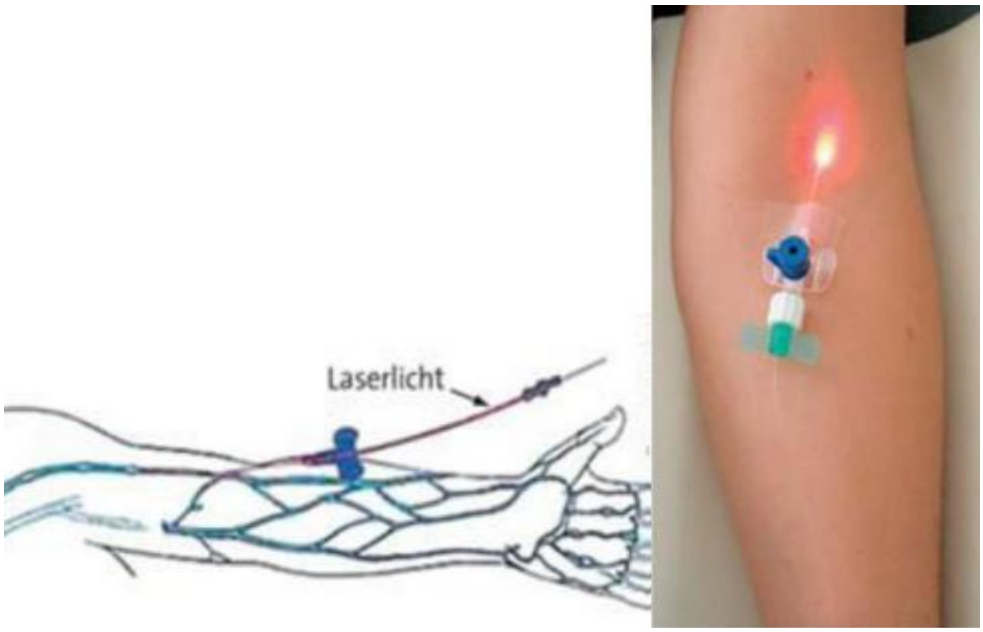


Image taken from the International Journal ISLA edition. Weber needle technology

1.3 PONTINEN'S PRINCIPLE

Continuous wave (CW) laser requires a dosage in joules to elicit a phototherapeutic response. Pontinen's Principle is designed to maximize treatment response in a single visit and to ensure that sufficient dosage has been provided. The technique is to palpate the spasm and have the patient rate their pain. The laser is used to administer 6-8 J/cm2 directly to the spasm. Upon completion of the treatment, clinicians will reassess for pain response. If pain persists, two additional applications may be given to get a treatment response.

Unlike CW lasers, super pulsed lasers emit beams that are always pulsed to set frequencies.

Generally, higher frequencies are used to stimulate tissue and for the relaxation of muscle spasm. Dosimetry for SP lasers is usually given in unit time (seconds), rather than joules. After assessing the patient's pain and spasticity of the muscle, set a frequency between 700 and 2500 Hz with the

SP laser and apply the dose for approximately 2-3 minutes with mild overpressure.

After re-palpating and re-assessing, continued pain or spasm can be treated up to two additional times to reduce pain and spasm. (Keep in mind that pulsed frequencies recommendations are general indicators).

EDITORIAL INSIGHTS.

Posted by Jan Tunér,Feb 19, 2017Annals Issue 1 2017, Annals of Laser Therapy Research, Clinical Applications

To pulse or not to pulse, that is the question

By Jan Tunér

The question of pulsing therapeutic light is not resolved and still rather controversial. This article is an edited version of a chapter in the 2014 book "Laser Phototherapy – Clinical Practice and Scientific Background" (Prima Books).

Pulsed or continuous light

A laser can work continuously (most typical for InGaAlP, HeNe, and GaAlAs lasers) or pulsed (such as the GaAs laser). The GaAs laser (904 or 905 nm) is always super-pulsed, with two possible consequences. Firstly, the pulsing of the laser light may interfere with other pulsing phenomena in the organism, and secondly, continuous/switched and super-pulsed lasers may have different active depths of penetration. A super-pulsed laser always penetrates deeper than a continuous or switched laser with the same wavelength and the same average output power. The extremely intense light flashes of the GaAs laser achieve greater light intensity extending deeper into the tissue.

Pulse repetition rate (PRR)

Few aspects of laser therapy cause so much confusion as the concept of pulsing. So let us try to make it a bit easier.

1. It is important to understand the difference between "switching" and "super pulsing". Continuous lasers can be pulsed through mechanical or electronical devices. This means that the continuous beam is shut on and off.

The power of the beam remains the same. If the “on-time” and the “off-time are the same, then the so called “duty cycle” is 50%. This means that the average laser power is 50% of the continuous wave power. If the laser is in the on mode during 90% of the cycle time, then the duty cycle is 90%, i.e. close to continuous. With 50% duty cycle the treatment time has to be doubled in order to achieve the same [energy or energy density] dose as with a continuous beam.

Consistent schedule of treatments augment the accumulative effects enhancing outcomes.
Occasionally, pain can increase following the first few treatments,

DEGRASE SKIN BY CLEANING
- •. WITH ALCOHOL OR SANITIZER

POSITION PATIENT FOR
MAXIMUM EXPOSURE TO TARGET TISSUE
- •. On BROKEN SKIN, COVER

CLUSTER OR AREA WITH
CLEAR PLASTIC WRAP FOR BARRIER
- USE PROTECTIVE GOGGLES

WHEN USING THE LASER, AND
USE PROTECTIVE GOGGLES ON THE PATIENT
- POSITION LASER OR

SCANNER IN CLOSE PROXIMITY TO THE SKIN.
PROGRAM DEVICE FOR TIME, JOULES, POWER OR OTHER
- DO NOT MOVE DEVICE DURING TREATMENT

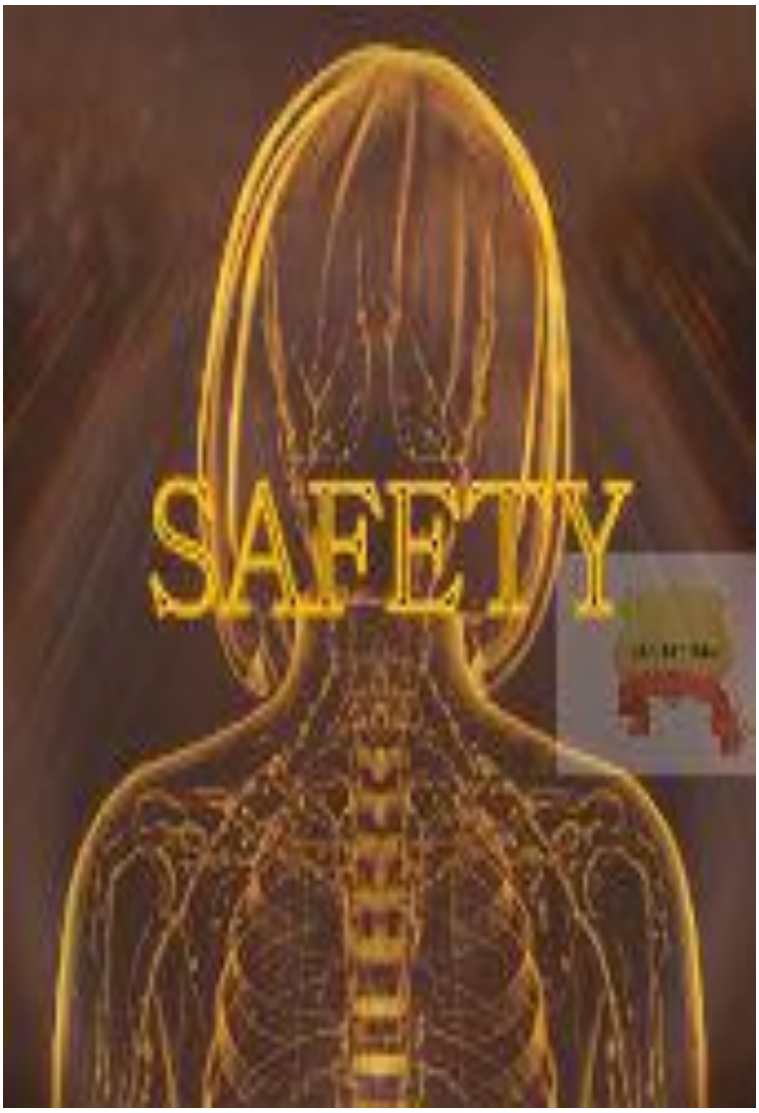
(2 - 4 hours post treatment until the next day).
This is referred to as a 'treatment reaction', an indication that the light energy may have "pushed" the chronic condition into a sub-acute phase of healing. Forewarn patients so ice or analgesics can be used. Once this pain subsides, pain levels are generally less than pre-treatment ratings.
Next session, decrease treatment dose by 50%and gradually increase over time.
Frail individuals, small children and patients with degenerative rheumatoid arthritis, fibromyalgia or other autoimmune conditions should be treated initially with smaller doses.
Gradually work up to full dosage.

Patients are frequently assessed and discharged when response is adequate.

1.16 USE OF OTHER MODALITIES

Other Physiotherapy modalities may be unnecessary with phototherapy.
If combining modalities, treatment sequence is important:
If icing, use before phototherapy
(Vasoconstriction decreases blood flow, improving light penetration).
If massage or heat generating therapy (e.g. ultrasound, e-stim) is used, apply after phototherapy.
(Vasodilation increases blood flow, diminishing penetration of light).

SECTION TWO



OSHA, ANSI AND FDA STANDARDSAND OCCUPATIONAL SAFETY

SECTION TWO

SKILLS DEVELOPMENT IN THIS SECTION

UNDERSTANDING OF LASER SAFETY
PRACTICAL MANAGEMENT OF LASER SAFETY
FDA RECOMMENDATIONS
SAFETY IN OWN PRACTISE

CONTENTS

2.1 LASER CLASSES

Lasers and laser systems are assigned one of four broad Classes (I to IV) depending on the potential for causing biological damage. The biological basis of the hazard classes are summarized below.

Class I: cannot emit laser radiation at known hazard levels (typically continuous wave: CW 0.4μW at visible wavelengths). Users of Class I laser products are generally exempt from radiation hazard controls during operation and maintenance (but not necessarily during service).
Since lasers are not classified on beam access during service, most Class I industrial lasers will consist of a higher class (high power) controls are recommended. Laser enclosed in a properly interlocked and labelled protective enclosure. In some cases, the enclosure may be a room
(walk-in protective housing) which requires a means to prevent operation when operators are inside the room.

Class I.A: a special designation that is based upon a 1000-second exposure and applies only to lasers that are "not intended for viewing" such as a supermarket laser scanner. The upper power limit of Class I.A. is 4.0 mw. The emission from a Class I.A. laser is defined such that the emission does not exceed the Class I limit for an emission duration of 1000 seconds.

Class II: low-power visible lasers that emit above Class I levels but at a radiant power not above 1 mw. The concept is that the human aversion reaction to bright light will protect a person.
Only limited controls are specified.

Class IIIA: intermediate power lasers (CW: 1-5 mw). Only hazardous for intrabeam viewing.
Some limited controls are usually recommended.

NOTE: There are different logotype labelling requirements for Class IIIA lasers with a beam irradiance that does not exceed 2.5 mw/cm2 (Caution logotype) and those where the beam irradiance does exceed 2.5 mw/cm2 (Danger logotype).

Class IIIB: moderate power lasers (CW: 5-500 mw/1000mw, pulsed: 10 J/cm2 or the diffuse reflection limit, whichever is lower). In general Class

IIIB lasers will not be a fire hazard, nor are they generally capable of producing a hazardous diffuse reflection.

Class IV: High power lasers (CW: 500 mw, pulsed: 10 J/cm2 or the diffuse reflection limit) are hazardous to view under any condition (directly or diffusely scattered).

These lasers have Area potential fire hazard and a skin hazard. Significant controls are required of Class IV laser facilities.

2.10 STANDARDS OF COMPETENCE IN PROFESSIONAL PRACTISE(in Laser therapy)

1) PROFESSIONAL ACCOUNTABILITY
The physical therapist:

• Practices in a safe manner that minimizes risk to patients, self and others.

• Completes documentation related to physical therapy practice in an appropriate, legible, and timely manner that is consistent with all applicable laws and regulatory requirements.
• Supervises assistive personnel and students in a manner that assures safe and efficient care.

• Consistently and critically evaluates sources of information related to physical therapy practice, outcomes research and education and applies knowledge from these sources in a scientific manner and to appropriate populations.

• Selects and utilizes outcomes measures to assess the results of interventions administered to individual and groups of patients.

• Communicates effectively with clients, caregivers and professional colleagues.

2) PROFESSIONAL BEHAVIOR

The physical therapist:

• Conducts critical self-assessment in order to practice to the fullest extent of knowledge, skills and abilities and takes responsibility to make accommodations as necessary.

• Demonstrates an understanding of and compliance with all laws and regulations governing the practice of physical therapy in his/her jurisdiction.

• Forms a professional relationship with patients/clients, colleagues and other members of the health care team in an effort to maximize patient/client outcomes.

• Avoids potential conflict of interest situations and circumstances that could be construed as harassment or abuse of patients, colleagues, associates or employees.

• Demonstrates sensitivity to individual and cultural differences when engaged in physical therapy practice

• Demonstrates knowledge and works to accommodate health disparities for individuals and the community at large.

3**) PROFESSIONAL DEVELOPMENT**

The physical therapist:

• Demonstrates lifelong learning to identify, acquire and apply knowledge, skills and abilities required for current physical therapy practice.

• Develops the knowledge, skills and abilities to communicate, manage knowledge, mitigate error and support decision-making utilizing information technology

9. **COMMANDMENTS ABOUT SAFETY**

Everybody is responsible for own and others safety in the workplace

All accidents are preventable

Follow company policies

Assess the risks. Stop and think.

Be proactive in Safety

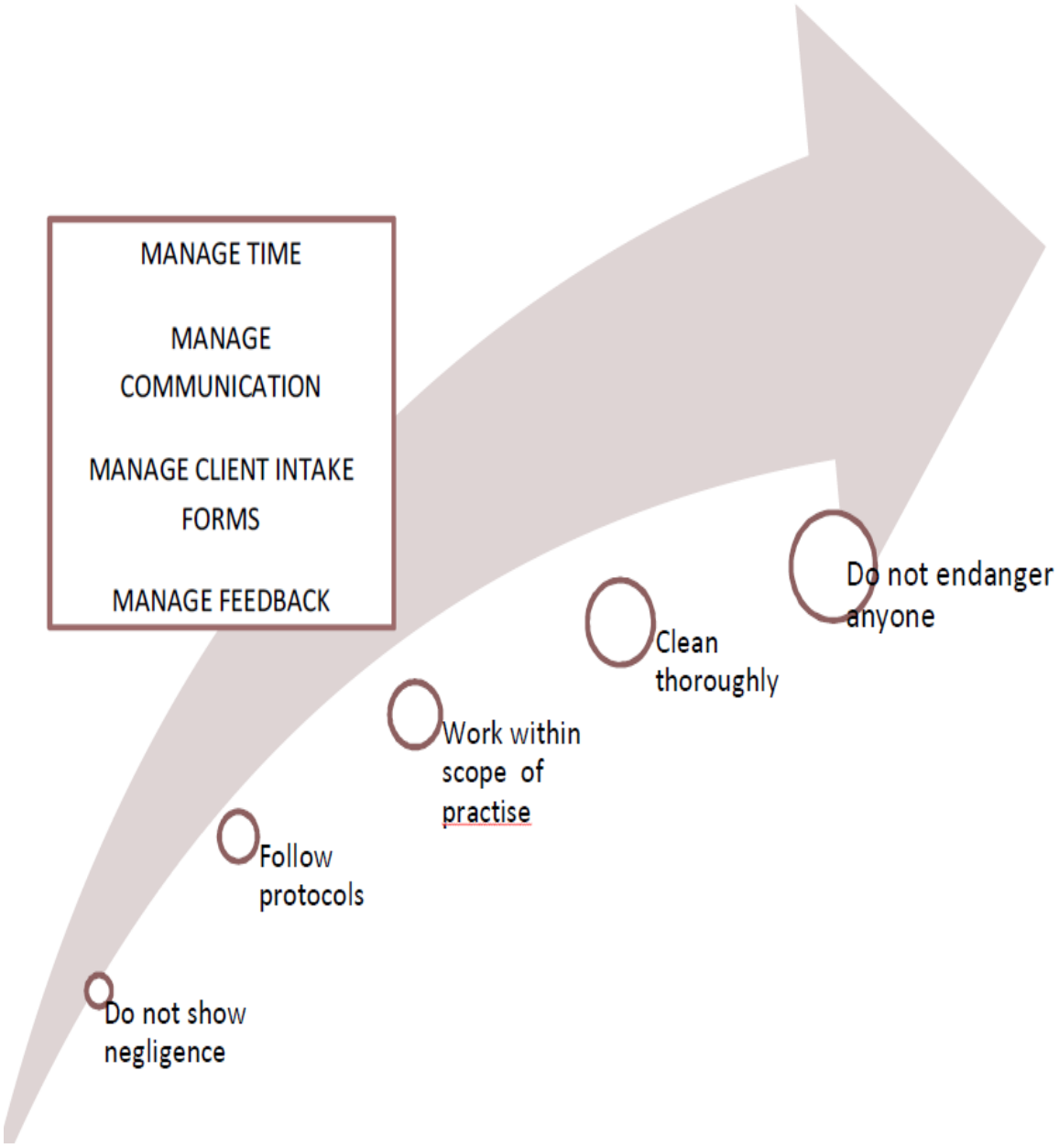
Don’t take shortcuts

Get trained support

Be prepared

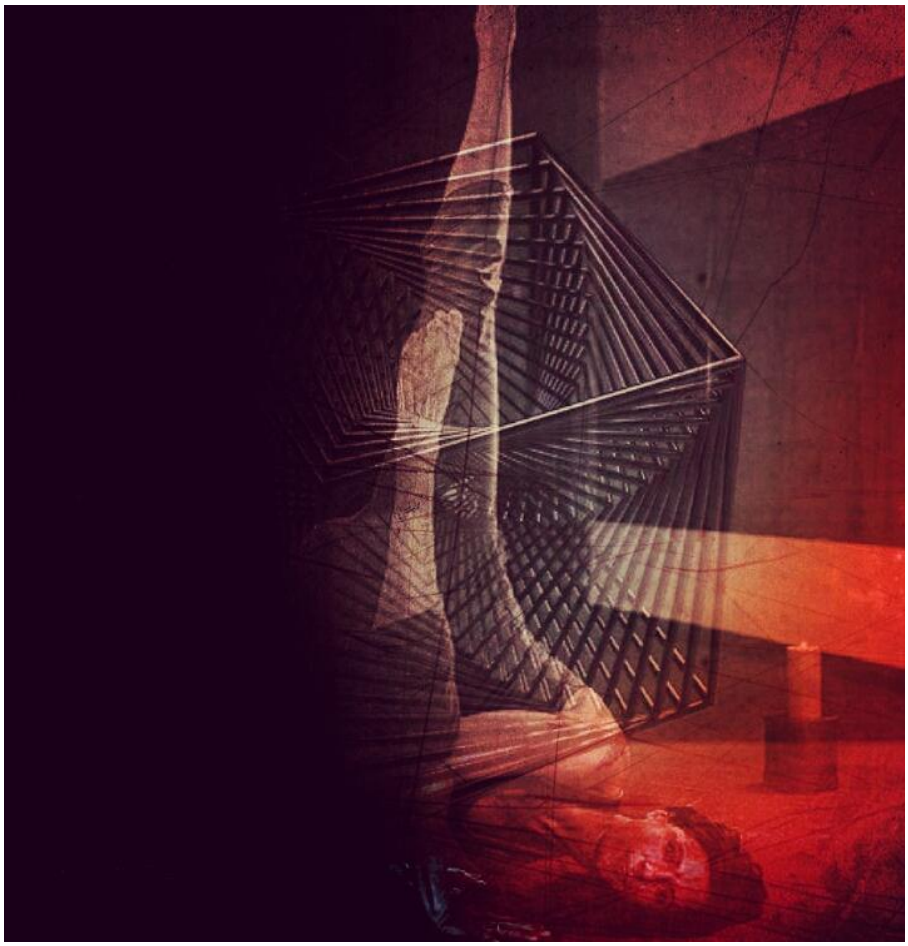
Review daily. Manage internal and external audits especially at times of change.

HIGHLIGHTS


MANAGE TIME
MANAGE COMMUNICATION
MANAGE CLIENT INTAKE FORMS
MANAGE FEEDBACK
Do not endanger anyone
Clean thoroughly
Work within scope of practise
Follow protocols
Do not show negligence

SECTION 3

MYOFASCIAL RELEASE WITH LOW LEVEL LASER THERAPY
>UNDERSTANDING THE ANATOMY OF THE MYOFASCIAL SYSTEM
>UNDERSTANDINGMYOFASCIAL DYSFUNCTION
>LOW LEVEL LASER THERAPY FOR TRIGGER POINTS AND



MYOFASCIAL RELEASE

SKILLS DEVELOPMENT IN THIS SECTION

KNOWING THE FASCIA AND ITS DYSFUNCTIONAL PATTERN
APPLYING TRIGGER POINT THERAPY USING LLLT
DEVELOPING TREATMENT PROTOCOLS FOR PT
FOLLOWING WALT GUIDELINES

CONTENT

3.1 The Myofascial Anatomy.
3.2 Superficial and deep fascia
3.3 Myo fascialdysfunction
3.4 Trigger points in Myofascial dysfunction.
3.5 More on Trigger points 3.6 Aetiology on TP's
3.7 Treatment of TP's
3.8 Peak and Output
3.9 Scientific Approaches to detecting Trigger Points
3.10 Application and techniques: Pontinen's Principle
3.11 Treatment Protocols
3.12 On reassessment
3.13 NAALT: Managing a treatment protocol for acute sports injury
3.14 Some general treatment dosage guidelines
3.15 Other guidelines
3.16 On treatment of tendons
3.17 SOAP for Myofascial dysfunction

3.1 MYOFASCIAL ANATOMY

Fascia, is a connective tissue that is continuous throughout the body, and is considered the 'skeleton' of soft tissue. It is pervasive, encompassing nerves, muscles, lymph vessels, organs, the brain and more.

Fascia serves the following functions
1) It forms and supports. It gives shape to the body and its component parts and holds them in place
2) It restricts. By providing firm boundaries it improves muscle strength. Muscles without fascia are considerably weaker.
3) It guides and moulds. Damaged bone deprived of periosteum (fascia) does not heal appropriately. In bad cases it can form adhesions between structures and alter healthy tissue.
4) It contains and compartmentalizes. Fascia contains and channels body fluids, helping to prevent infection from spreading.
5) It provides infrastructure for branching systems. It supports capillaries and vessels of the circulatory and lymphatic systems, as well as the ubiquitous branching of the nervous system.
6) It gives rise to new connective tissue. It contains fibroblasts, proliferated by low level laser to thicken connective tissue, repair tendons, ligaments, stimulate growth factor and re densify impaired tissue.

3.2 SUPERFICIAL OR DEEP FASCIA

SUPERFICIAL FASCIA

The superficial fascia is also called the hypodermis, sub cutis, or stratum subcutaneum. It is located directly under the skin and contains fat, fascicles of muscle tissue, cutaneous blood vessels and nerves, and about half of the fat in the body.
Superficial laser beams and LEDS penetrate this tissue.

DEEP FASCIA

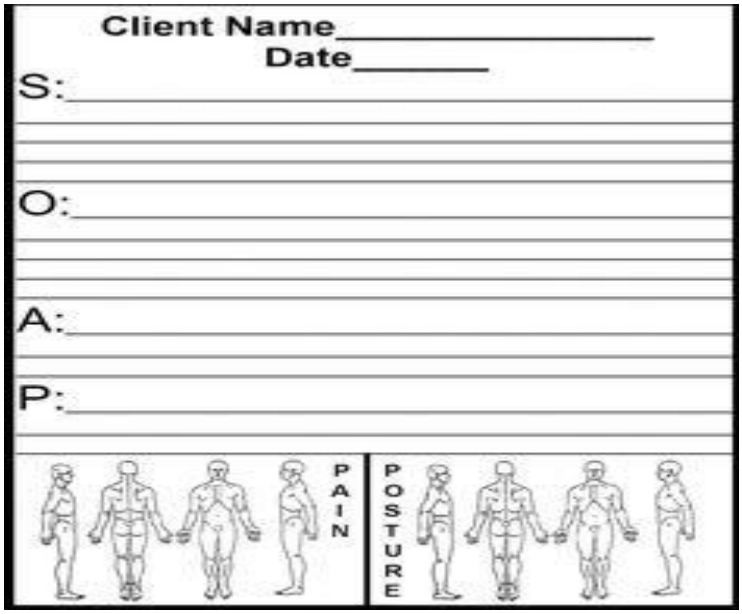
The deep fascia is all of the fascia that is deep to the superficial fascia, with which it is continuous. Deep fascia includes the fascia covering a group of

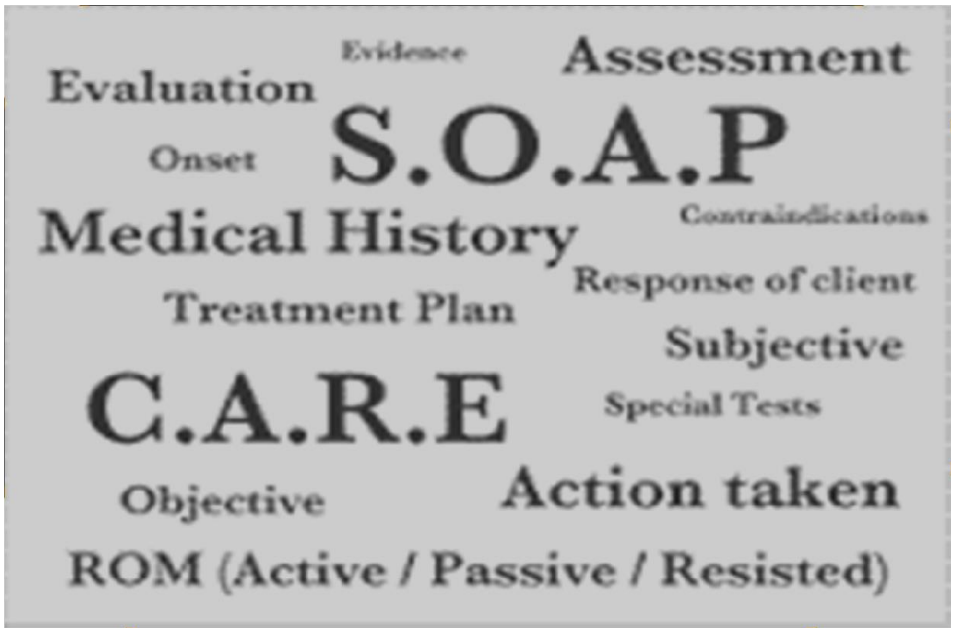
3.17 SOAP FOR MYOFASCIAL DYSFUNCTION

STANDARDIZED CONSULTATION

Subjective, Objective, Assessment Plan

SAMPLE SOAP FORM.
Manage client intake, consent and records with great care





Create Highly Detailed SOAP Notes

This is a required skill for compliance in physical therapy to clinical processes and enables audit, or data for case referral to other units of physical therapy.

Highly detailed SOAPs can be written in seconds...
Every component of the SOAP note must be saved for that patient visit . SOAP is Subjective, Objective, Assessment, Plan notes

Subjective

Introduction

The first part of the SOAP contains important information that the provider may want to know prior to treating the patient. Here mention reason for visit, appointment scheduling note, insurance case, appointment history, treatment plan and re-evaluation

Condition

The current condition case for the patient including the case name, primary diagnosis, start date and general notes.

List of Macros Include

Complaints, History of Present Illness, Follow up Visit Response to Care
Auto Accident Form, Personal Injury History, Visual Analog Pain Scale
Quadruple Visual Analog Pain Scale, Organ Non/Skeletal Complaint
Muscular Subjective-Upper & Lower, Extremity/Cervical Thoracic Spine
Dermatomes, Activities of Daily Living Affected, Outcome Assessment
Asymptomatic Wellness Visit, New Patient Health History
Review of Systems, New Patient Family Health History
Daily Habits, Improved Since Last Visit, Same Since Last Visit
Worse Since Last Visit, Naturopath, Personal Health History

Objective

Vitals

SECTION 4

LYMPHATIC TREATMENTS USING LOW LEVEL LASER THERAPY

ANATOMY OF THE LYMPHATIC SYSTEM . LYMPHEDEMA
LOW LEVEL LASER THERAPY IN TREATING THE LYMPHATIC SYSTEM

SKILLS DEVELOPMENT IN THIS SECTION

KNOWLEDGE OF LYPHEDEMA TISSUE CONDITIONS
PRINCIPLES OF LASER APPLICATION
TECHNIQUES OF LASER LYMPHATIC DRAINAGE
WALT DOSE RECOMMENDATIONS

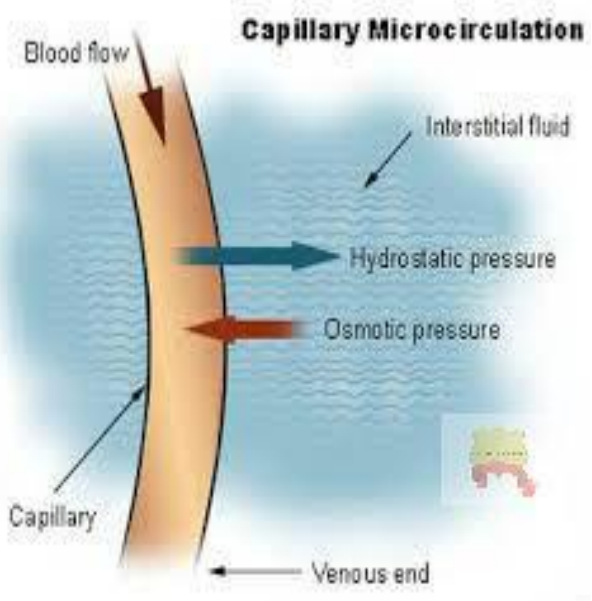
CONTENTS

4.1 THE LYMPHATIC SYSTEM

The Lymphatic system is a relatively recent discovery in medicine. It is an extension of the Circulatory system. Lymphatic vessels and capillaries narrow down from the arteries to become a miniature transport system existing at the periphery of the skin. In a normal state the lymphatic move fluid to underlying and adjoining vessels and maintain the tone of the skin.
Disease or injury may express in the lymphatic system causing toxicity, oedema and hardening of tissue.

The lymphatic system is a large system that moves fluid through ducts, vessels and thousands of bean shaped nodes in the body. The fluid is made up of water and proteins that feed the cells in the body. Lymph fluid is collected in the lymph vessels, filtered through the lymph nodes and it eventually drains into the bloodstream through large ducts in the chest (thoracic ducts).

The proteins are recycled or leave the body as waste in the urine.
The lymphatic system works with the lungs, muscles and the vascular system called the circulatory system. This is the system that pumps blood and supplies oxygen to the cells. The lungs and muscles are also important in moving lymph fluid through the body.



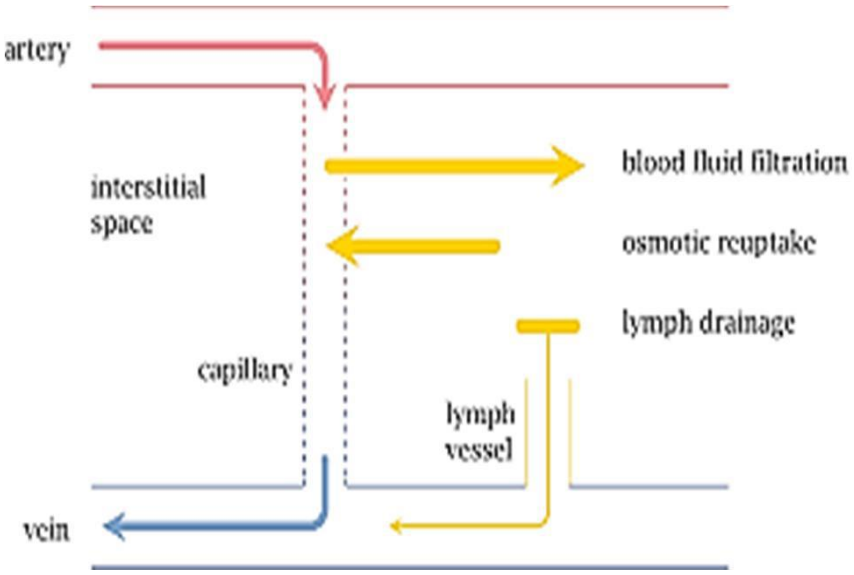
4.2 FUNCTIONS OF THE LYMPHATIC SYSTEM

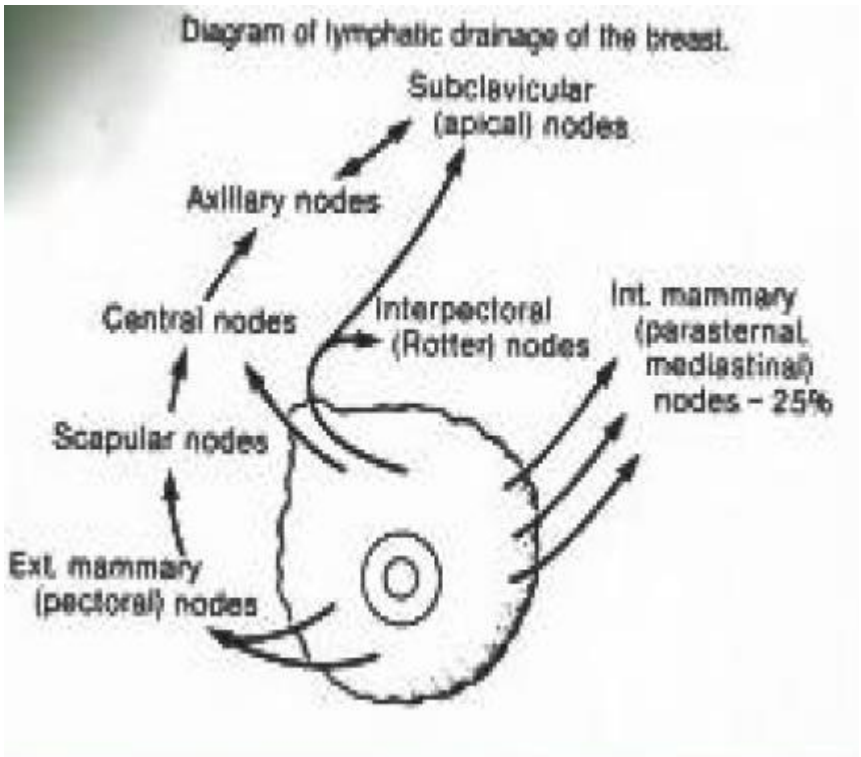
The lymphatic system has two functions.

1) The main function is to help the circulatory system maintain a balance of fluid in the body. Fluids are needed to bring nutrients to, and remove waste products from cells. Every day about three litres of fluid is left behind in the tissue spaces of the body. The lymphatic system absorbs this fluid and returns it to the blood stream. This prevents swelling and balances the fluid in the body. Incredibly, the lymphatic system can handle up to ten times the normal amount of fluid in your body for a short period of time.

2) The other important function is to help defend the body from disease. When bacteria and viruses are detected in the fluid by the lymph node, it triggers special cells to remove them.This is why someone might feel some swollen nodes in the neck or armpit (Axillary) at times of infection or illness.

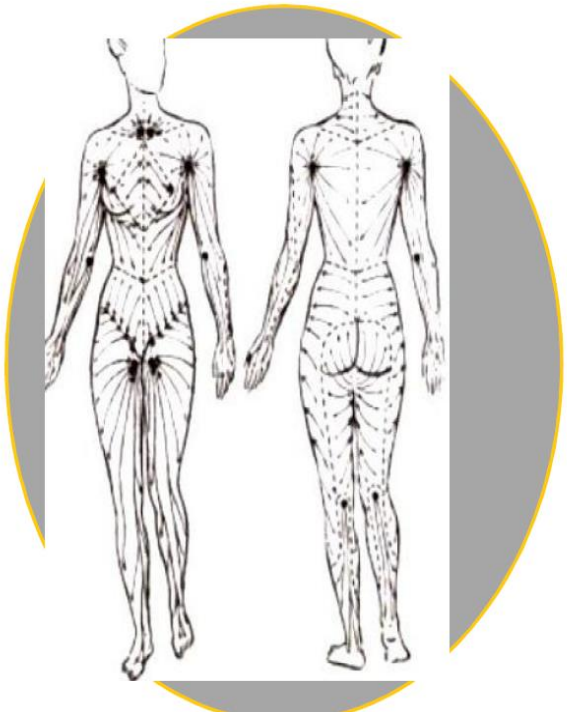
Diagram below shows the pathway of lymph vessels. Capillaries move from the circulatory





The direction of lymph needed with laser must be assessed to determine the precise node to be fed.

This can be developed and assessed in the SOAP



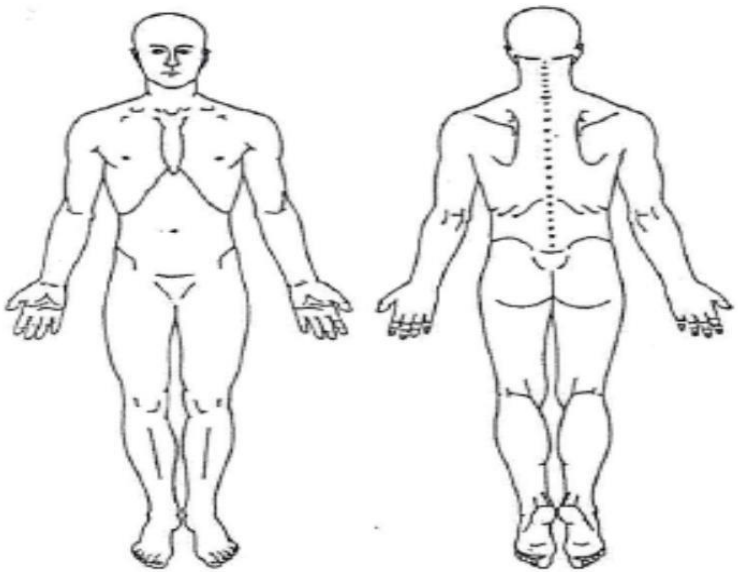
4.14. SOAP FOR LYMPHATICS

S Daily SOAP Notes

LYMPHATICS
Name of patient, therapist, health care center, date and time of meeting. Details as reported by the patient should be marked in a separate chart

O Draw arrows for Lymph direction
Mark the nodes to be flushed. Circle the areas with excess lymph
Manage to indicate repetition of strokes or duration needed for effective drainage based on quantity of accumulated fluid.

A __Therapists name_____, Laser lymphatic drainage
treated the above areas of concern utilizing body region appropriate, and patient
condition/tolerance appropriate, massage strokes and techniques. The laser/manual therapy was preformed from _____ am/pm to _____ am/pm on the above captioned date.



P – Laser Therapy Techniques (ie. Single probe -woodpecker, cluster probe- scanning or stationary exposure).

SECTION FIVE

LASER ACUPUNCTURE

THE NATURE OF ACUPUNCTURE POINTS
POINT SELECTION PROTOCOLS

MICROACUPUNCTURE
LASER ACUPUNCTURE FREQUENCIES

SKILLS DEVELOPMENT IN THIS SECTION

KNOWLEDGE OF ACUPUNCTURE POINTS USED COMMONLY WITH LASER
PRINCIPLES OF APPLICATION
MICROACUPUNCTURE TECHNIQUES
SELECTION OF LASER FREQUENCIES FOR POINTS
WALT DOSE RECOMMENDATIONS

CONTENTS

5.1 THE NATURE OF ACUPUNCTURE POINTS

Acupuncture point stimulation triggers a response in the CNS (opposed to TR pts which belong to the PNS).

Acupuncture points, upon stimulation, have shown a stronger pattern of firing in the hypothalamus than stimulation of non-acupuncture areas.

Acupuncture points in one of the many theories, are considered to be foci of embryonic origin, around which other cells and body parts developed. They therefore influence the meridian and the body area more comprehensively than non-acupuncture treatments. They have micro representation in miniature as in the hands, feet and ear. They also have pervasive and systemic influence.

Dr Nogier of France developed research on the embryonic origin of the points and frequencies in laser reactive to embryonic endodermal, mesodermal or ectodermal tissue.

Acupuncture science is several thousand years old, and belongs to China as a legacy from an evolved saint. The texts are complex to interpret. Modern science in laser acupuncture is based on rational scientific enquiry, and knowledge outcomes that are understood by practitioners to support medical therapies.

Apart from points and their descriptions, Classical acupuncture theory is based on meridians and five elements which will not be discussed much in this course.

Approaches to five element theory and diagnostics for treatment requires a multiple probe laser for applying to the YIN and Yang point simultaneously to achieve meridian balance. Excess is drained and deficiency is reinforced. This treatment requires classical assessment of symptoms and personality which are non-medical for our purpose. Although we have every respect for practitioners of this system.

Acupuncture points in thermography, show up as ‘hot spots, with low electrical resistance in comparison to the surrounding sites.

Some authors have found that AP's coincide with TP's. Others have found differences in the nature of both. Both TP's and AP's are significant in therapy.

5.2 POINT SELECTION PROTOCOLS

1. **AH SHI POINTS**

These are points in close proximity to an injured area or pathological organ that develop tenderness so that the patient expresses pain AH when pressure is applied. These points are different from TP's as they belong to the CNS. They are highly reactive and curative in treatments and must be listed in treatment protocols.

5.3. BACK SHU POINTS

These are para vertebral points belonging to the Bladder meridian which lies 3 cms lateral to the dorsal midline between T3 and S4. They are reflex (SHU) points for the organs as under.

- T3 - T7: Lung. Pericardium, Heart, Governor Vessel (and spine), Diaphragm (and blood).

- T9 - T12: Liver, Gallbladder, Spleen (and blood/immunity), Stomach.

- L1 – L5: Triple Heater (Endocrine/respiration/digestion/elimination), Kidney, Large Intestine

-S1 – S4: Small Intestine, Bladder

In disorders of the organs or limbs, the relevant Shu point of the corresponding dermatome becomes sensitive.

Tender Shu points are given along with AH SHI points and TP points for therapies involving management of pain, and increased range of motion.

Koel, Moolenaar, en Castel

Dermatology	
Scars (too soft)	3-6 J/cm²
Scars (painful keloids)	0,5-1 J/cm²
Decubitus	0,1-2 J/cm²
Ulcus	0,1-2 J/cm²
Transplantation wounds	0,1-1J/cm²
Rheumatic/orthopaedic	
Tendinitis/peritendinitis	0,5-4 J/cm²
Periostalgia	0,5-2 J/cm²
Bursitis	0,5-2 J/cm²
Fasciatis plantaris	0,3-1 J/cm²
Capsulitis	0,5-3 J/cm²
Myositis	0,5-2 J/cm²
Posttraumatic treatment	
Distortions	0,5-2 J/cm²
Rupture	0,5-3 J/cm²
Haematoma	0,5-3 J/cm²
Oedema	0,5-2 J/cm²
Neurology	
Neuralgia	0,05-0,8 J/cm²
Neuritis	0,05-0,8 J/cm²

Taken from: Laser Therapy for Sports Injuries.

RJ does not recommend such low energy levels. We think that the energy should be at least between 2-5 Joule on pale skin and higher dosage on dark skin.

5.8 EXPERTS ON ACUPUNCTURE

In fact, Enwemeka has stated on LIGHT. The present view is that light has a dual character. In its propagation it consists of electromagnetic waves, but when it interacts with matter in emission, absorption and scattering processes we must consider it as composed of photons. The photo-acupuncture process consists of the emission of light from a semiconductor chip, its scattering through the flesh and absorption into the nervous system, so it can only be sensibly described as a stream of photons. Terms such as

coherence and collimation describe waves, not particles, so are meaningless with photons.

When a photon decays, it becomes an electron with the same energy level. In photo-puncture,most photons decay in the tissues, but those which encounter the acupuncture point stimulate it electrically, thus sending patterns of stimuli to the brain. Photons are fundamental particles and differ from each

The present view other only in their energy level, i.e. their perceived colour. A red photon from a laser is identical with a red photon from a Gallium Aluminium Arsenide chip or from a burning match. Ascribing other properties to them would probably be contrary to modern physics. The objective is to achieve levels of stimulation which the brain cannot ignore.
With the previous technology, the only practical way of generating intense red or infrared light strong enough for the brain to recognize was a gas (helium-neon) laser or a solid state laser. In order to get a useful power output, it was necessary to pass high current pulses through these
devices. With the latest technology, this is no longer necessary for high light output.

The nervous system works by an interchange of sodium Na+ and potassium K+ ions, a slow process which could never follow these high pulse rates. What has been demonstrated is that the end effect depends upon the total energy into the acupuncture point. This can be mechanical. Heat, electrical, chemical. Sound, magnetic or here, light energy. It has to be above
a certain threshold, or the brain ignores it, so the rate at which the energy is injected by the time of application is the key to success.

5.9 SOAP FOR LAP

Care must be taken to be seen to be listening; full attention needs to be given to the person who is speaking. More detailed notes can be written whilst the patient is preparing for the treatment or between appointments. The consultation is an essential part of the healing process. Patients appreciate the time and attention being paid to their problem. The more patients understand and are involved the more comfortable they are likely to be with their treatment. Copies of the patients chart and treatment plan can easily be given or sent on to the patient if required. Treatment Record Systems A number of treatment record formats exist including SOAP and CARE notes.

The system you use doesn't need to be an acronym, you can adapt or develop your own format but it should satisfy certain minimum requirements.

Image is sourced from www.cooperativemedicine.com/acupuncture

Editorial Note from Jan Tuner in Laser Annals Back Issue 2. 2015

Laser acupuncture works – but how?

The results of the meta-analysis seem to be a sound scientific support for the actual existence of all the reported effects. But knowledge about the mechanisms is still scant. And ADP/ATP connection has been suggested and would make sense. But there are still many remaining questions. Is wavelength important? Which is the best energy? Does it matter?

Advancement in laser acupuncture has been seen in recent years. The "laser needle" idea makes it possible to apply high energies more precisely on the

small acupuncture points. Further to that, different wavelengths can be chosen for superficial and deeply located points, and it is now possible to irradiate many acupoints at the same time, as done in needle acupuncture.

Summing up: Laser acupuncture is not placebo but similar to needle acupuncture. Enough documented to be used, especially considering the fact that it is non-invasive and pain free. Knowledge about the mechanisms will come with time. Just knowing that it is real is for the time being good enough.

SECTION SIX

ADVANCES IN SYSTEMIC TREATMENTS WITH LOW LEVEL LASER THERAPY

THIS IS A KNOWLEDGE SECTION BASED ON ADVANCED TECHNICAL SKILLS IN LASER THERAPY. THE LEARNER WILL NOT BE ASSESSED FOR KNOWLEDGE OUTCOMES INTRAVENOUS LASER THERAPY FOR SYSTEMIC DISEASES

SKILLS DEVELOPMENT IN THIS SECTION

ADVANCED SKILLS IN BLOOD LASER THERAPY

6.1 INTRAVENOUS LOW LEVEL LASER THERAPY. ILT *(Intravenous laser therapy)*

Blood Irradiation - Introduction of a New Therapy
The method of intravenous laser blood irradiation was first introduced into therapy by the Soviet scientists E.N.Meschalkin and V.S.Sergiewski in 1981 [32].

Later Karu published significant research to contribute to the understanding of this field. Dr Michael Weber from Germany invented the Weberneedle system for popular application, and introduced a premier board dedicated to medical laser acupuncture called ISLA (International Society of Laser Acupuncture). DR Weber's system was approved by FDA, and tested by Mayo clinic with favourable outcomes.

DR Weber further introduced advances in variations of laser wavelengths used in intravenous laser, and in the combination of intravenous photosensitizers as an adjunct to intravenous laser for treatment of malignant tumours and metastases.

Effects of intravenous Low-Level-Laser-Therapy of the blood

1. Laser blood irradiation produced anti-inflammatory effects that improved the immunologic activity of the blood.

2. A fundamental finding was the positive influence on
Rheological properties of the blood which is of greatest interest to surgery, angiology and cardiology

3. A diminishing tendency of aggregation of thrombocytes and an improved deformability of erythrocytes result in an improved oxygen supply and with that to a decrease of partial which is particularly relevant to wound healing.

4. The phagocytic activity of macrophages was improved in conjunction with structural modifications.

Continued Profile of Jan Tuner

JAN TUNER : Continuation of reference list of his scientific published work2-Papers:

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Certification program of The Swedish Laser Medical Society

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