



8th International Congress of the
WORLD ASSOCIATION FOR LASER THERAPY

25th – 28th September 2010
BERGEN, NORWAY



Program and Abstracts .

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Grieg Foundation is non-profit foundation and a shareholder in the Grieg Group. Grieg Foundation is focusing on contributions to support and develop children and youth. Many of the projects are in the intersection between youth work and culture work. Grieg Foundation supports SOS Children Villages to give talented SOS youth an education which further will have impact on the development in their home country.

Other contributions are given mainly towards cultural and other benevolent projects in western Norway. Considerable contributions are made to regional opera projects, orchestral music, and the annual Bergen International Festival (Festspillene i Bergen). Medical projects, cultural and humanitarian work also receive support from Grieg Foundation. The NorPhyPain research group lead by Professor Jan M Bjordal, has received long-term contributions to their laser therapy research from the Grieg Foundation. The WALT2010 congress is sponsored by Grieg Foundation.

Welcome

WELCOME TO THE WALT2010 CONGRESS

It is a great pleasure for me to welcome you to the 8th International Congress of the World Association of Laser Therapy (WALT) in Bergen, gateway to the Fjords of Norway. WALT was formed in 1994 in Barcelona, Spain at the joint Congress of the International Laser Therapy Association (ILTA) and the International Society for Laser Application in Medicine (ISLAM) when these two international groups merged and WALT became the leading world body for promoting research, education and clinical applications in the field of phototherapy with lasers and other light sources. The multi-national membership includes the world's leading experts in all forms of treatment mediated by the photobiomodulating effects of light occurring without major thermal effects on irradiated tissue. The aims of WALT include the promotion of evidence-based clinical application of laser therapy in the fields of medical practice, dentistry, veterinary medicine and allied health professions; encouragement of research into the clinical application of phototherapy in accordance with internationally accepted standards of best practice; promotion of laboratory-based research into mechanisms of photobiomodulation; encouragement of education, international co-operation and a forum for information exchange and the establishment of an international reference body for accreditation of standards in research and education in laser therapy across all disciplines.

The LASER concept was introduced in 1960 and the first LASER was built by Theodore Maiman. This year is actually the 50 years anniversary for LASER. At the time of introduction, the LASER was viewed upon as something new, but probably useless, because nobody saw the potential uses of the LASER. For struggling scientists working to gain acceptance in controversial areas or with new innovations, it is comforting to remember that Maiman's scientific work was initially rejected by the scientific journals. Since then, the LASER has been a success story with numerous applications in medicine, beginning with uses in ophthalmology in the 1960's. Today, surgical class 4 lasers are used in tissue cutting, blood coagulation, arterial plaque removal, dental drilling applications. WALT and the congress focus mainly on applications of class 3 B lasers or kindred narrow-band light sources in biological systems. This includes their use in basic science and translation into clinical use for healthcare purposes. Traditional drug development is a one-way street where safety is a major topic and treatment evolves from biochemistry and the molecular basis of pathology, through in vitro, in vivo and in situ studies. Contrary to drugs and their numerous side-effects, laser therapy is safe by the definition of international radiation agencies, if eye protection is ensured. Another difference is the interaction between empirical observations in clinical practice, and the quest for biological mechanisms that can explain them. We think that this collaboration between basic science and clinicians and across disciplines which is WALT's trademark, is particularly fruitful and rather unique in medical research.

In 1995 it was stated that laser therapy was still not an established tool. The statement pointed out that promising results in laboratory failed to translate into positive clinical results. Today, 15 years later there has been a 20-fold increase in the number of controlled scientific studies in the field. In my opinion, the lack of acceptance for laser therapy into today's healthcare is hampered more by professional and political negligence than rightful scientific scepticism.

In Pubmed. there are now around 6000 scientific articles about laser therapy and the Pedro database of controlled clinical trials contains 136 hits. In the last two years, the amount of scientific evidence for laser therapy in clinical conditions has reached a level similar or above that of painkiller drugs in some musculoskeletal disorders. We have also seen great advances in dentistry, bactericidal use, nerve pathologies and wound healing. We are proud to present the leading researchers of the world in our congress in collaboration with Bergen University College.

Welcome and enjoy our scientific program!
Jan M Bjordal, President, WALT

Committees

World Association for Laser Therapy (WALT) Members of the Executive Council

Jan Magnus Bjordal (Norway)	<i>President</i>
Farouk Al-Watban (Saudi Arabia)	<i>Past President</i>
Heidi Abrahamse (South Africa)	<i>President Elect</i>
Kevin Moore (UK)	<i>Treasurer</i>
Jan Tuner (Sweden)	<i>Membership Secretary</i>
Antonio Pinheiro (Brazil)	<i>Secretary General</i>
Rodrigo Lopes-martins (Brazil)	<i>Scientific Secretary</i>
Chukuka Enwemeka (USA)	<i>co-editor Photomedicine and Laser Surgery</i>
Shimon Rochkind (Israel)	<i>co-editor Photomedicine and Laser Surgery</i>

WALT-2010 International Scientific Committee.

<i>Professor PhD/PT(President)</i>	Jan M. Bjordal (Norway)
<i>Assoc. Professor PT PhD</i>	Jan Hendrik Demmink (Norway)
<i>PhD Student MSc PT</i>	Jón Joensen (Norway)
<i>Assoc. professor PT PhD</i>	Ernesto Leal Junior (Brazil)
<i>Professor PT/PhD</i>	Chukuka Enwemeka (USA)
<i>Head of School PT/PhD</i>	Liisa Laakso (Australia)
<i>Professor PT/PhD</i>	Nivaldo Parizotto (Brazil)
<i>DDS</i>	Jan Tuner (Sweden)
<i>Assoc. Professor DDS/PhD</i>	Lucio Frigo (Brazil)
<i>Professor DDS/PhD</i>	Antonio Pinheiro (Brazil)
<i>DDS/PhD (Oral surgery)</i>	Lado Loko Loro (Norway)
<i>Professor DDS/PhD (Oral surgery)</i>	Paul Bradley (USA)
<i>Professor DDS/PhD</i>	Reza Fekrazaad (Iran)
<i>Assoc. Professor PhD (Physiol)</i>	Vegard V. Iversen (Norway)
<i>Assoc. Professor PhD (Pharmacol)</i>	Rodrigo Lopes-Martins (Brazil)
<i>Principal Scientist PhD (Physics)</i>	Farouk Al.Watban (Saudi Arabia)
<i>Professor PhD/(Biol)</i>	Heidi Abrahamse (South Africa)
<i>Assoc. Professor PhD (Org Chem)</i>	Michael R. Hamblin (USA)
<i>Professor PhD/ (Anatomy)</i>	Juanita Anders (USA)
<i>Research Fellow MD PhD</i>	Roberta Chow (Australia)
<i>MD/PhD (Neurosurgery)</i>	Shimon Rochkind (Israel)
<i>Professor MD/PhD (Oncology)</i>	Rene-Jean Bensadoun (France)
<i>MD/PhD (Phys Med&Rehab)</i>	Jeffrey R. Basford (USA)
<i>Professor MD/PhD (Anaesthesiology)</i>	Soheila Mokmeli (Iran)

WALT-2010 Local Organizing Committee.

Jan M. Bjordal (President)	Jón Joensen
Geir Brandal	Frode Arnøy
Bård Bogen	Kristin Aase
Jan Hendrik Demmink	Lado Loko Loro
Vegard V Iversen	Kjersti Gjerde

Information



Bergen now, overcast and 12 degrees Celsius

Check live webcam at :
<http://www.bt.no/kamera/article161.ece>

Dear valued WALT2010 participant

We sincerely welcome You to Bergen, gateway to the Norwegian Fjords. This letter is giving some practical information which might be useful for your stay in Norway.

Airport transfer

Upon arrival at Bergen airport, Flesland, You will find the airport bus right outside the terminal building taking you to Bergen city centre. It leaves every typically every 15 or 20 mins and takes about 25 mins to Bergen city. Before 21.00 hours some airport buses can take you directly to the venue hotel SAS Radisson Blu Bryggen, which is the last stop (see map below). Ask the driver upon entering the bus. The bus tickets cost 90 NOK for a single fare and NOK 150 for a return fare. The airport is situated 23 kilometres away from the congress hotel, and typical taxi fare from the airport to the venue hotel cost NOK 300 at daytime and 350 NOK at night.

Currency

The Norwegian currency is in Kroner (NOK) and current exchange rates are 1 € = 8 NOK and 1 \$= 6.10 NOK. Credit cards are widely accepted and numerous ATMs are available for cash withdrawals.

Climate

The weather in Bergen is typical for areas influenced by the North Atlantic region, and rain showers or even longer periods of rain must be expected. We may be lucky and have sunny weather, because everything looks nicer in good weather. Typical temperatures for this time of the year is 12-14 degrees Celsius.

Language

Norwegian is the native language, and it is quite similar to Danish and Swedish. Most Norwegians speak English as a second language and you should have little trouble in making yourself understood in shops and the transportation system. Although Norwegians have a reputation of being a little introvert, most Norwegian people will be happy to help you if asked.

Smoking restrictions

Smoking in public areas is forbidden in Norway, and You will have to move outside of public buildings to be able to smoke. This restriction is part of the official public health policy in Norway, and cigarettes are heavily taxed and quite expensive.

Expensive alcohol

Beer, wine and spirits are also heavily taxed and expensive. A pint of beer cost or a glass of wine 60-80 NOK at a restaurant. Bringing a bottle or two for personal use in the hotel rooms is a good idea. You may even purchase this at Bergen airport from the airport taxfree shopping by the arrival gates before going downstairs to the baggage claim area.

Information

Shopping

Norway is a rather expensive country to live in. Shopping is easy, but expensive, and you will find all the most common international brands represented in the shopping centres. There are several shopping malls in the city centre like Galleriet, Exhibition, Kloverhuset and Bergen Storsenter. Sporting gear and outdoor clothing goods are usually of high quality and Norwegian knitwear from Dale of Norway or Oleana are very popular among visitors.

Crime

Norway has one of the lowest crime rates in the world, but that does not mean that it does not exist. You will be safe walking in the streets even after dark, although we recommend you to be careful with walking alone in the city centre after midnight in weekends.



E x h i b i t o r s

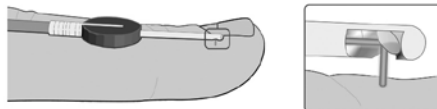
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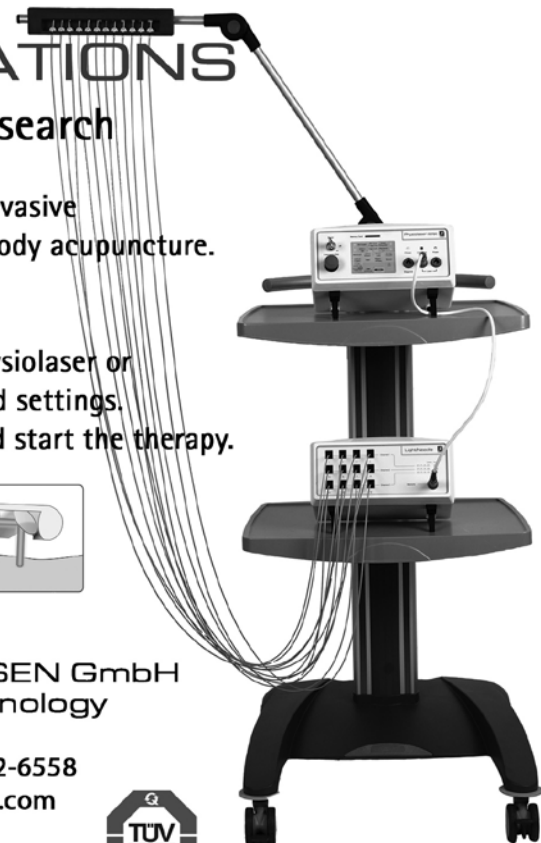
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contact@rj-laser.com

Tel. +49-7682-6558
www.rj-laser.com

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www.lightneedle.de



How much power is enough? how much is too much?

In a recent systematic review and meta analysis of laser therapy on tendinopathies (Tumilty) 11 out of 20 studies failed to produce a positive result. The reason identified for the ineffective studies were that the laser beams were too strong (the irradiance was too high).

Most clinicians are confused about which laser to choose and which dose or technique will work. Laser can inhibit as well as stimulate and the techniques and settings for achieving these effects are not always clear to everybody. Should you use laser or LED, red or infrared wavelengths, use a strong or a low power laser, use pulses or continuous, treat twice a day or twice a month? THOR considers these questions every day.

THOR are best placed to supply and train because we are constantly developing our expertise in LLLT. We do this by participating in all the key international LLLT conferences, researching for and writing the literature watch section of the Photomedicine journal. We are involved in laboratory and clinical research trials across the world and are putting our knowledge into practice every day at the Amersham Clinic (UK). Our academic interest and practical experience keeps us informed and helps develop our training which means that THOR customers get the best possible support for treating with laser.

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Exhibitors

6TH INTERNATIONAL LASER THERAPY CONFERENCE

June 9th, 10th & 11th, 2011 • Sheraton Centre Toronto Hotel, Canada



Shimon Rochkind, MD
ISRAEL



Chukuka Enwemeka, PhD
USA



Mary Dyson, PhD
UNITED KINGDOM



Uri Oron, PhD
ISRAEL



Roberta Chow, MD, PhD
AUSTRALIA

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**Register before October 31, 2010*

For more great speakers and additional conference information please visit:

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To register please contact Melissa at 1-888-557-4004 or conference@bioflexlaser.com

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Exhibitors



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Exhibitors



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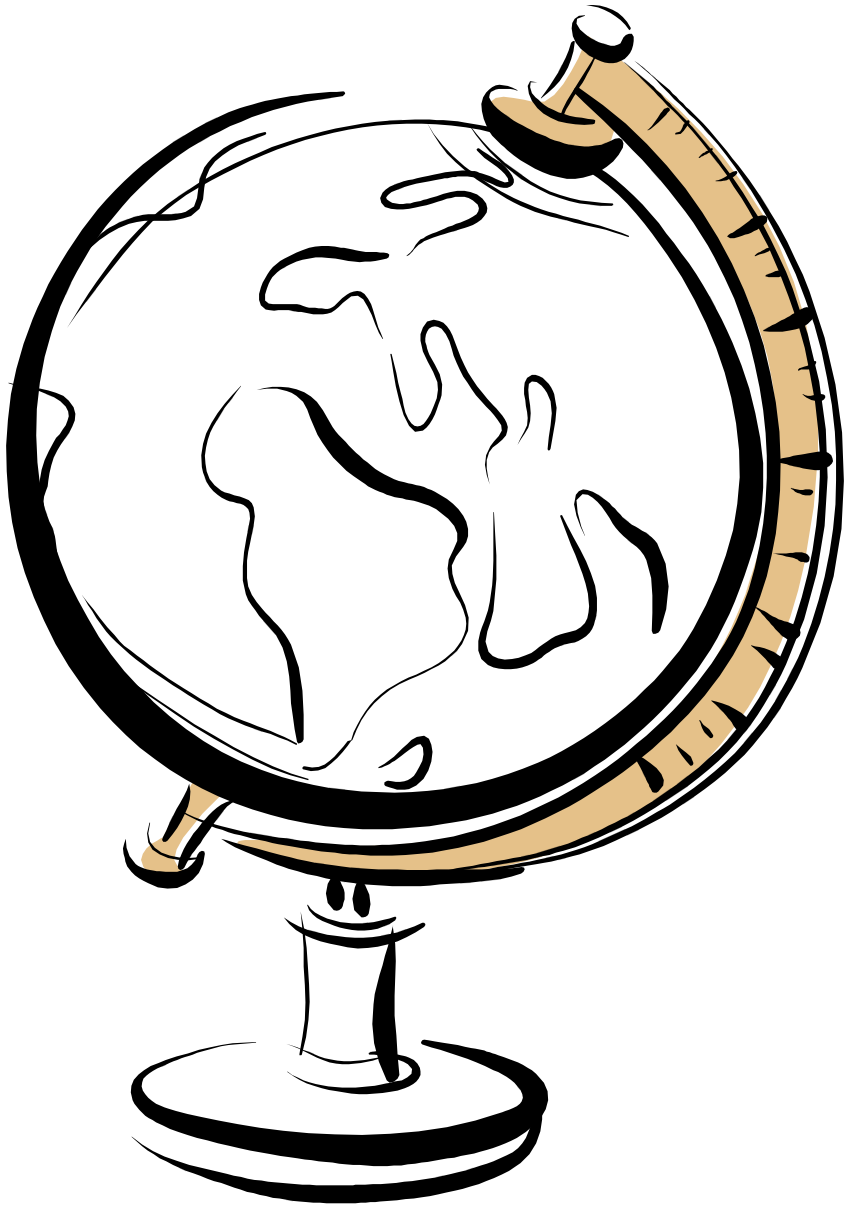


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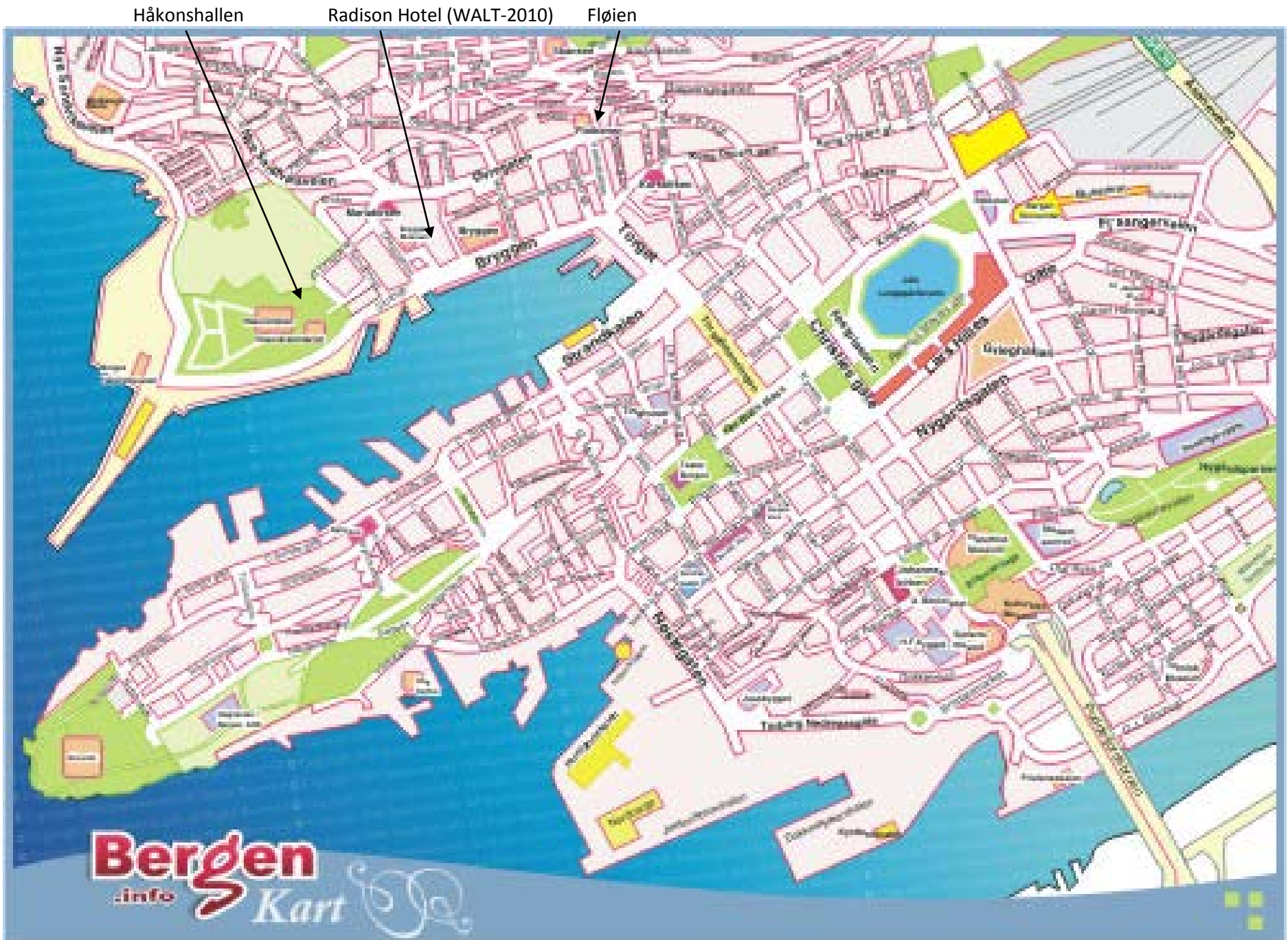


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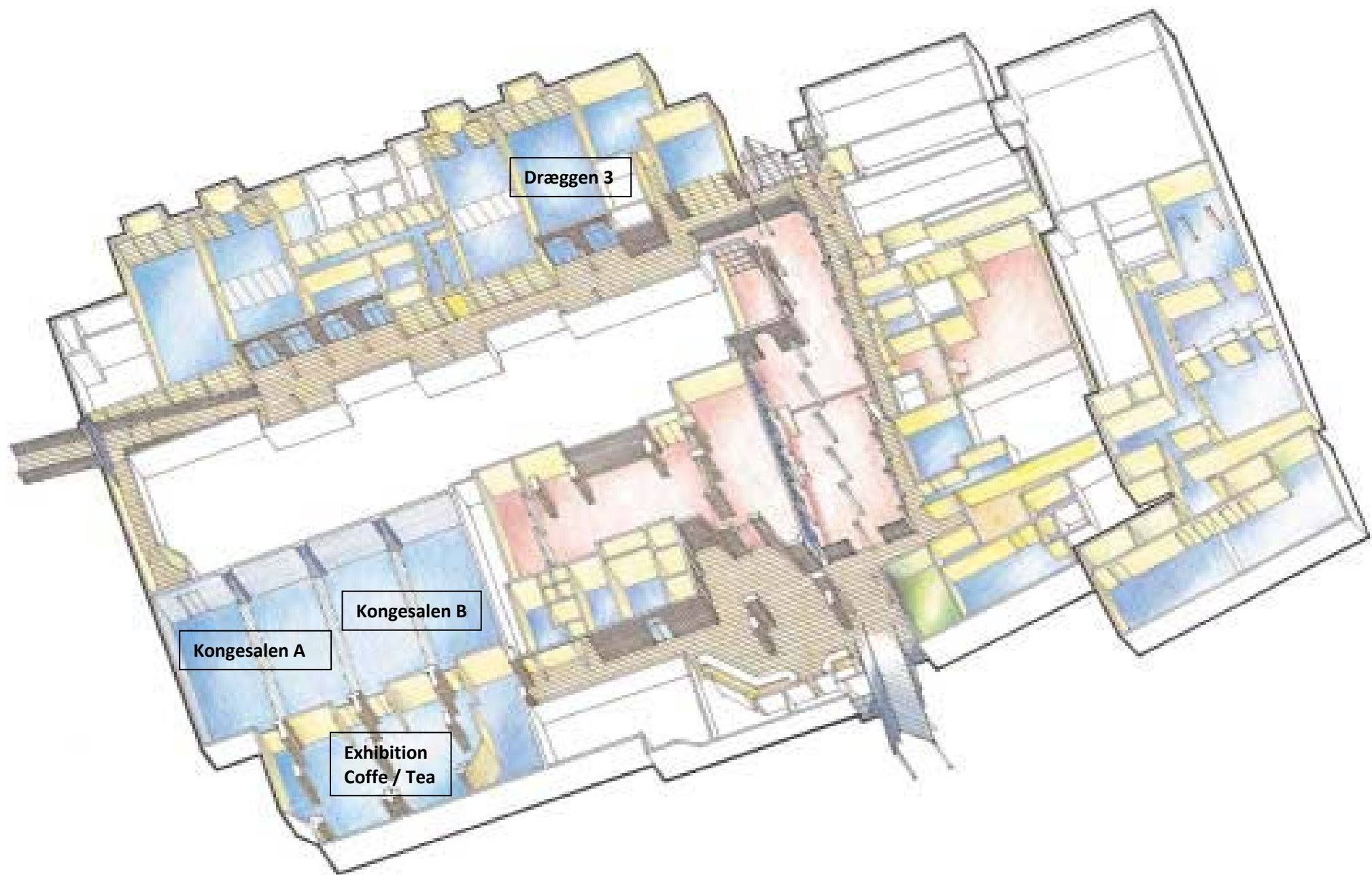


Maps and Social Program



Map

Radisson SAS Royal Hotel, Bergen



Social Program

Get Together party at RAdisson Blu Royal Hotel on September 25th 2010

After the Scientific program ends on Saturday, there will be an informal Get Together at the conference hotel Radisson Blu Royal Hotel. Enjoy some light Norwegian Tapas and wine with your friends and colleagues! Included in the conference fee.

Gala Dinner "On The Roof Top of Bergen" at Mt Fløyen on September 26th 2010.

Experience the thrilling funicular ride up the steep mountain side, to the top of mount Fløyen. The venue for tonight's dinner will hence be situated 1050 ft above sea level! The view of Bergen and the surrounding fjord area is purely breathtaking! Upon arrival at the top, the group will have time to enjoy the views from the viewing platform before the walk the 150 metres to the Restaurant Fløyen. The restaurant is situated in a beautiful and elegant building and do truly offer unrivalled view of the city of Bergen. Enjoy an 3 course dinner with friends and colleagues! You will really find it difficult not to fall in love with this town, after a visit to Mount Fløyen! Register for the gala dinner at the conference desk during Saturday.

Price, per person **NOK 880.00**



City Reception at Haakon's Hall on September 27th 2010

The city of Bergen cordially invites the WALT 2010 participants to a 1 hour Welcome Reception at 19.30 hours in the impressive **Haakon's Hall**, which was erected during the reign of King Haakon Haakonsson between 1247 and 1261. It was the largest and most imposing building of the royal residency in the 13th-century when Bergen was the political center of Norway. It is owned by the Bergen City Council and is used only on special occasions as the official city of Bergen representation venue. **Haakon's Hall** is situated in Bergen Harbour only 200 metres from the congress venue hotell. Entrance is included in the conference fee. The rest of the evening is free for Your disposal.



Biography



B i o g r a p h y

Keynote speaker - Biography

Michael
Hamblin,
USA



Saturday
25th Sept.
14:00

Michael Hamblin is a Principal Investigator at the Wellman Center for Photomedicine at Massachusetts General Hospital and Associate Professor of Dermatology at Harvard Medical School. He was trained as a synthetic organic chemist and received his PhD from Trent University in England. He joined Wellman Labs in 1994. He worked initially in targeted photodynamic therapy (PDT) and prepared and studied conjugates between photosensitizers and antibodies, targeted proteins and polymers of varying charge. His research interests are now broadly in the area of phototherapy for multiple diseases. One focus is the study of new photosensitizers for infections, cancer, and heart disease. A second focus is low-level light therapy (LLLT) for wound healing, arthritis, traumatic brain injury and hair regrowth. He has developed an interest in elucidating the basic molecular and cellular mechanisms of LLLT, and for the past four years has chaired an annual Photonics West conference for SPIE entitled "Mechanisms for Low Level Light Therapy". His latest research has been focusing on the biphasic dose-response of LLLT and differences between pulsed and continuous light therapies. Dr. Hamblin has published over 95 peer-reviewed articles, over 100 conference proceedings, book chapters and international abstracts, and he holds eight patents. He is an associate editor of the Journal of Photochemistry and Photobiology B.

Keynote speaker - Biography

Roberta
Chow,
Australia



Sunday
26th Sept.
08:00

Dr. Roberta Chow MB BS (Hons) FRACGP MAppSci (Med Acu) PhD is a medical doctor trained in acupuncture and has been working clinically with LLLT in private practice since 1988. Her desire for knowing more about the mechanisms behind LLLT prompted her to start an academic career at the Nerve Research Foundation, Brain & Mind Research Unit at the University of Sydney, Australia. She has performed systematic reviews about LLLT in osteoarthritis and neck pain, and has performed two important high quality randomized placebo-controlled trials of LLLT in non-specific neck pain as part of her PhD at the University of Sydney. She received the award for "best clinical research" at the WALT 2008 congress in South Africa. Her interest into the pain-relieving mechanisms of LLLT has resulted in elucidating a new mechanism for inhibition of pain signals through axon block in small diameter peripheral nerves. She is currently pursuing these findings in her post-doctoral projects.

Keynote speaker - Biography

Jeffrey
Basford,
USA



Monday
27th Sept.
08:00

Jeffrey R. Basford is a physician and a Professor of Physical Medicine and Rehabilitation at the Mayo Clinic in Rochester, Minnesota, USA. Beside his medical education he also holds a PhD in Physics. He is a long-time editor and currently Editor in Chief of the leading international journal *Archives of Physical Medicine and Rehabilitation*. Professor Basford is a true pioneer in the area of Low Level Laser Therapy and he published his first laboratory trial with LLLT in 1986, and his first randomized placebo-controlled trial already in 1987 with patients suffering from thumb osteoarthritis. In 1995 he summed up the status of LLLT as “still not an established tool”. He published three more randomized placebo-controlled trials with LLLT in lateral epicondylitis, plantar fasciitis and low back pain with mixed results and “retired” from the LLLT research scene, before returning with a systematic review of LLLT in tendinopathies in 2010. In this review, it was concluded that 12 LLLT studies “provide strong evidence that positive outcomes are associated with the use of current dosage recommendations for the treatment of tendinopathy”. In his presentation at WALT2010 professor Basford will focus on how LLLT researchers, as well as those in any controversial field, can lessen resistance to the publishing and acceptance of their findings.

Keynote speaker - Biography

Jan Magnus
Bjordal,
Norway



Tuesday
28th Sept.
08:00

Professor Jan M. Bjordal graduated as a physiotherapist in 1982 at the State School of Physiotherapy, Bergen, Norway, his Master degree in Health Sciences in 1998 at University of Bergen, Norway and his PhD (Doctor Philosophiae) from the same university in 2003. Bjordal became a full professor in 2007. His current affiliations are with Bergen University College and University of Bergen, and he is a visiting professor at Leeds Metropolitan University, UK from 2009-2011.

Professor Bjordal participated in the Norwegian Health Technology Assessment of physiotherapy in knee osteoarthritis in 2004, and in 2007 he was an external advisor for the Norwegian Low Back Pain guidelines. His publications are cited in several guidelines for the management of osteoarthritis of the knee and hip.

Professor Bjordal has been critical to the frequent lack of dose-response considerations in Cochrane reviews for physical treatments. While insisting on maintaining an independent role outside the Cochrane Collaboration, he has been acting as an external referee for several Cochrane reviews in musculoskeletal disorders. Prof. Bjordal's main area of research has been to identify mechanisms and optimal doses for physical agents in pain treatment. He has been a member of the board World Association for Laser Therapy (WALT) since 2004, and as Scientific Secretary he has been leading WALT's development of guidelines for research and clinical application of low level laser therapy (LLLT).

In 2008, Professor Bjordal was awarded the Muscle & Skeletal prize by the Norwegian Manual Therapist Association, and the Neck & Back Pain prize at the first joint Norwegian Neck & Back Pain congress for his LLLT studies. Professor Bjordal is currently President of World Association for Laser Therapy and president of the WALT2010 congress. Bjordal has authored 77 scientific publications, 50 in Medline-indexed journals and some of them in high-ranked journals like British Medical Journal, The Lancet and Annals of Internal Medicine, and he is on the editorial board of four scientific journals.

Invited speakers - Biography



Tiina I. Karu

Education

- Tartu University, Estonia, student in physical chemistry
- National Cancer Research Centre of USSR Acad. Med. Sci., Moscow, graduate student in photochemistry and chemical carcinogenesis with Academician. L.M. Shabad
- 1974 - degree of Cand. of Sci. in photochemistry (Ph.D. as US equivalent)
- 1990 - degree of Doctor of Sci. in biophysics, St.-Petersburg, Russia

Professional experience

- Institute of Chemistry of Estonian Acad. Sci., Tallinn, Estonia, research fellow in photochemistry and photobiology
- Institute of Physics of Estonian Acad. Sci., Tartu, Estonia, research fellow in photophysics and laser biology
- 1980-currently - Laser Technology Research Centre of Russian Acad. Sci. (from 1.01.2000 - Institute on Laser and Informatic Technologies of Russian Acad. Sci.), Head of Laboratory of Laser Biology and Medicine



Rodrigo A B Lopes Martins

Dr. Rodrigo Alvaro B. Lopes Martins is a Professor at the Department of Pharmacology, Institute of Biomedical Sciences at the University of São Paulo. He had a Master Degree in Pharmacology at the Medical School of the State University of Campinas in 1994. His PhD thesis was finished in 1998 in Cell and Molecular Biology at the Oswaldo Cruz Foundation, and a Pos-Doctoral training in Pharmacology at the State University of São Paulo.

Dr. Lopes-Martins Has been working with Low Level Laser Therapy since 2002, using a pharmacological approach in order to elucidate the anti-inflammatory mechanism of Laser Therapy. During this period he was able to publish several medline-indexed papers in this area.

In the last years his main research area is the study of laser therapy in experimental models of musculo-skeletal inflammatory disorders such as osteoarthritis, tendonitis and muscle strain, as well as, clinical implications of the therapy.



PROFESSOR PAUL BRADLEY MD BDS FDS FRCS

Dr Bradley is Professor and Vice Chairman of Oral Diagnostic Sciences at Nova Southeastern University at Fort Lauderdale, Florida. He is Director of the Head and Neck Pain Clinic there, where Low Intensity Laser Therapy (LILT) is an important treatment modality and subject for research. In 2005, he was President of the North American Association for Laser Therapy (NAALT), hosting the Annual Conference at Nova. Dr Bradley is the editor of a text book on Cryosurgery and over 60 publications, with 12 chapters in text-books, concentrating on minimally invasive surgery and lasers. Before moving to the USA four years ago, he was Professor and Chair of Oral and Maxillofacial Surgery in the Universities of London and Edinburgh. He was recipient of

the Down Medal for outstanding service to Oral and Maxillofacial Surgery.

Invited speakers - Biography



Heidi Abrahamse

Prof. Heidi Abrahamse BSc (RAU), BSc Honours Biochemistry and Psychology (US, UNISA), MSc (US), PhD Molecular biology (Wits), was born in Klerksdorp, South Africa and graduated from the University of the Witwatersrand in 1997. She has been associated with several tertiary education institutions, where she has contributed by conducting and establishing research units and research management structures and compiling policy documents for research. She serves on several research-related university committees including the Academic Ethics and Higher Degrees Research Committees. She has lectured several undergraduate as well as post-graduate courses and currently heads the Laser Research Group, an established Research Centre in the

Faculty of Health Sciences at the University of Johannesburg.

She has graduated more than 25 post-graduate students, published 40 peer reviewed international research papers including chapters in books and hold grants for research from several national research funding bodies such as the Medical Research Council, the National Research Foundation, the Council for Science and Industrial Research and the National Laser Centre. She holds membership and honorary advisorship to several international societies and research bodies (WALT, SASBMB, ASBMB; ASCB, SPIE, OSA, WALA) and acts as reviewer for several funding bodies and international journals. Her research areas of interest include phototherapy, laser-tissue interaction, signal transduction in cancer, wound healing and stem cell differentiation.



Juanita J Anders

PRESENT POSITION

Professor, Department of Anatomy, Physiology and Genetics, F. Edward Hebert School of Medicine, Uniformed Services University of the Health Sciences (USUHS)

EDUCATION

Postdoctoral Training
Laboratory of Neuropathology and Neuroanatomical Sciences, National Institute of Neurological and Communicative Disorders and Stroke, National Institutes of Health (1977-1980)

1977 - Ph.D.

Anatomy, University of Maryland Medical School

Thesis Title: The organization and autonomic innervation of the vascular system of the mammalian spinal cord.

1972 - M.S.

Zoology, Pennsylvania State University

Thesis Title: The optic system of the teleost *Cichlasoma biocellatum*.

1969 - B.A.

Wilkes College, Pennsylvania, Department of Biology.

PATENTS

Title: LIGHT PROMOTES REGENERATION AND FUNCTIONAL RECOVERY AFTER SPINAL CORD INJURY.

Inventors: Juanita J. Anders, Ilko K. Ilev, Ronald W. Waynant and Kimberly R. Byrnes US Provisional #60/460,421 filed 4/7/2003, has been converted to US Patent Application 10/820,443 filed 4/7/2004, and US Patent Application 11/022,314 filed 12/23/2004.

This technology has been licensed and is being developed by PhotoThera, Inc., a specialty biotechnology company that was formed to develop FDA approved medical devices using light.

Title: LIGHT AS A REPLACEMENT FOR MITOGENIC FACTORS ON PROGENITOR CELLS Inventors: Tara B. Romanczyk and Juanita J. Anders (USU), Ilko K. Ilev, PhD (FDA), and Leonardo Longo, MD, PhD

Invited speakers - Biography

(Institute of Laser Medicine, University of Siena, Siena, Italy) Provisional Patent Application: No. 60/666,582 filed 03/31/05, Patent Cooperation Treaty Patent Application No. PCT/US06/11573 filed on 3/30/2006

EDITORIAL POSITIONS

Associate Editor, Journal of Neurocytology 1991- 2000

Editorial Board of Journal of Photomedicine and Laser Surgery 2003- Present

Editorial Board of Journal of Lasers In Surgery and Medicine 2005

REVIEWER FOR THE FOLLOWING JOURNALS (1983-PRESENT):

Brain Research

Journal of Histochemistry and Cytochemistry

Journal of Comparative Anatomy

Lasers in Surgery and Medicine

Acta Anatomica

Journal of Photochemistry and Photobiology (Biology Section)

Journal of Selected Topics in Quantum Electronics

Journal of Clinical Laser Medicine and Surgery

Journal of Clinical Investigation

Journal of Peripheral Neurology

Expert Review of Neurotherapeutics

INVITED SEMINARS AND LECTURESHIPS, PUBLICATIONS AND COMMITTEES

Since 1979 I have presented at 38 seminars and international conferences, have over 57 publications. Currently I am the Director of Graduate Program for Anatomy, Physiology and Genetics, Chairman of the Graduate Advisory Committee and Member of the Search Committee for APG Faculty Positions. I am on the Graduate Education Committee, Laser Safety Committee and Research Proposal Merit Review Committee.

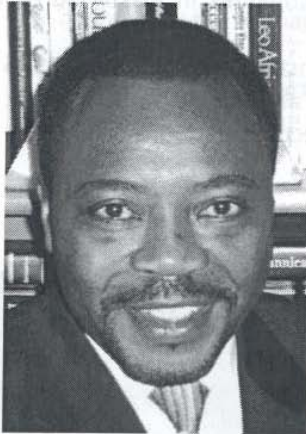


Ljubica M. Konstantinovic

Professor Ljubica M. Konstantinovic graduated from the Medical School of the University of Belgrade, Serbia in 1983, and in 1990 she completed the specialization in physical medicine and rehabilitation. From the same school, she obtained the Master Degree in rheumatology in 1990, titled: *Laser Photo-biostimulation of Acupuncture Points for Neck Pain*. In 1997, she defended the doctoral dissertation, titled: *The Mechanisms of Effects of Low-level Laser of Different Wavelengths for Indirect Neurotrauma Caused by Blast Lung Injury*. She has used lasers in clinical practice since 1987.

Konstantinovic is currently employed at the Clinic for Rehabilitation *Dr Miroslav Zotovic* of the Medical School of the University of Belgrade in the scientific field of physical medicine and rehabilitation as professor and director for research and education. She has lectured in undergraduate studies and several graduate courses in the Medical and Dentistry Schools as well as the School of Electrical Engineering of the Belgrade University. She has mentored more than 10 graduate students in the field of low-level laser therapy. Since 2002, she has been the organizer of the School of Low-level Laser in Physical Medicine and Rehabilitation for The Center for Continuing Medical Education of the Medical School of the University of Belgrade. She is the president of the Serbian Laser Association and the president of Expert Alternative Medicine Board of the Serbian Ministry of Health. She has also collaborated with The School of Electrical Engineering of the University of Belgrade in expert and scientific work as well as in the work of expert boards since 1987. She is a member of WALT, and World, European and Mediterranean Association of Physical Medicine and Rehabilitation (ISPRM, ESPRM and MFPMR). Professor Konstantinovic has published 145 publications, 80 on topics of low-level laser, from the basic to clinical applications in musculoskeletal and neurological syndromes, especially in painful conditions.

Invited speakers - Biography



Chukuka S Enwemeka

CURRENT POSITION

Dean and Professor School of Health Professions, Behavioral & Life Sciences

HIGHER EDUCATION

1985 Ph.D. Pathokinesiology, New York University, New York, NY
(Degree requirements completed in 1984; degree awarded in 1985)
1983 M.S. Musculoskeletal Physical Therapy, University of Southern California, Los Angeles, CA
1978 B.Sc. Physiotherapy, University of Ibadan, Nigeria (Formerly University of London, Ibadan Campus) Graduated With Upper Class Honors.

POST DOCTORAL TRAINING

1985-86 Tissue Culture Research Laboratory, Rusk Institute of Rehabilitation Medicine New York University Medical Center, New York.

BOARD CERTIFICATION AND LICENSURE

1983 PT License No. 11783 California Board of Medical Quality Assurance
1984 PT License No. 2981 New Jersey Board of Medical Examiner
1989 PT License No. 4053 North Carolina Board of Physical Therapy Examiners
1990 PT License No 6081 Florida Division of Medical Quality Assurance (Active)

PUBLICATIONS / PRESENTATIONS / WORKSHOPS

Over 250 Peer-reviewed original publications in accredited journals, Books & Monographs, Peer-reviewed Conference Proceedings & Invited Papers and Teaching Manuals.

Presented over 90 International Presentations, Lectures, Seminars and Workshops and 60 National and Regional Presentations, Lectures, Seminars and Workshops.

Received 9 appointments to review boards, related panels & non-university committees.

Received various honors and awards.

EDITORIAL BOARD & RELATED APPOINTMENTS

1. Co-Editor-in-Chief, *Photomedicine and Laser Surgery*, The Official Journal of the International Society for Laser Surgery and Medicine and The World Association for Laser Therapy, June 2004 to date.
2. Editor-in-Chief, *Laser Therapy*, The official Journal of the World Association for Laser Therapy, May, 2000 to January, 2004.
3. Co-editor-in-Chief, *Laser Therapy*, The official Journal of the World Association for Laser Therapy, since April, 1994 – May, 2000.
4. North America Regional Editor, *Laser Therapy* (July, 1991- April 1994).
5. Associate Editor, *Journal of the Nigerian Society of Physiotherapy* (1987-1989)
6. Editorial Board Member, *Journal of Orthopaedics and Sports Physical Therapy* (1988-1991)
7. Peer Reviewer, *Journal of Applied Physiology*, (2006 to date).
8. Peer Reviewer, *Laser Chemistry*, (2006 to date).
9. Peer Reviewer, *Journal of Biomedical Optics*, (2006 to date).
10. Peer Reviewer, *Lasers in Surgery and Medicine*, (2002 to date).
11. Peer Reviewer, *Photochemical and Photobiological Sciences*, (2005 to date).
12. Peer Reviewer, *British Journal of Sports Medicine*, (2005 to date).
13. Peer Reviewer, *Cell Biology International*, (2005 to date).
14. Peer Reviewer, *Photochemistry and Photobiology*, (2005 to date).
15. Peer Reviewer, *Physical Therapy* (1988-1992).
16. Peer Reviewer, *Physiotherapy Canada* (1988-1992).
17. Peer Reviewer, *Journal of Orthopaedic & Sports Physical Therapy* (1988-1992).

Invited speakers - Biography



Liisa Laakso

Dr Liisa Laakso is a Senior Lecturer in the School of Physiotherapy and Exercise Science, Griffith University (Gold Coast campus) and has been there since July 2002. Prior to that she had been employed in a conjoint position - as a Senior Physiotherapist in the Physiotherapy Services, Royal Brisbane and Royal Women's Hospital Health Services District; and as a Lecturer in the Department of Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland.

Clinical areas of interest include critical care, sports physiotherapy, chronic pain management and oncology/palliative care.

She completed her PhD in 1995 (investigating the role of therapeutic laser in the management of chronic pain) having received a Sir Robert

Menzies Memorial Scholarship to pursue those studies

Research interests in the field of laser therapy include its role in healing and repair of tissue, inflammation and pain, the management of lymphoedema, and the effect on tumours.

Selected publications:

- Laakso, E-L and Cabot PJ (2005) Nociceptive scores and endorphin-containing cells reduced by Low-Level Laser Therapy (LLLT) in inflamed paws of Wistar rat. *Photomedicine and Laser Surgery*, 23:32-35.
- Laakso, L., Richardson, C. and Cramond, T (1997) Pain Scores and Side Effects of Low Level Laser Therapy in the Treatment of Myofascial Trigger Points. *Laser Therapy*, 9:67-72.
- Laakso, L., Richardson, C. and Cramond, T. (1993) Quality of light - is laser necessary for effective photobiostimulation *Australian Journal of Physiotherapy*, 39:87-92.
- Laakso, L., Richardson, C. and Cramond, T. (1993) Factors affecting low level laser therapy. *Australian Journal of Physiotherapy*, 39:95-99.

Invited speakers - Biography



Gerhard Konrad Seeberger

Gerhard Konrad Seeberger studies and graduates in dentistry at the Julius-Maximilian-Universität Würzburg. Since 1986 he is a private practitioner in Cagliari (Italy). His main interests are oral surgery, implant dentistry, function and aesthetics in restorative dentistry and periodontology. He is a member of the

- Società Italiana per Osteointegrazione, SIO (Italian Society for Osseointegration)
- "Akademie Praxis und Wissenschaft" within the German Society of Dentistry (DGZMK)
- European Association for Osseointegration, EAO

- Bavarian Study Club of Periodontology (Founding member and Past-President)
- Accademia Italiana di Odontoiatria Protesica, AIOP
- Centri Laser in Odontoiatria e Dermatologia, CLOD (Vice-President)

He is a speaker in more than 100 national and international events and courses in Asia, Europe, North- and Central America lecturing on implant dentistry, periodontology, function and aesthetics in restorative dentistry and safety procedures in dental practice. He is an Honorary member of the Chicago Dental Society, CDS, the Romanian Association of Private Practitioners in Dentistry, AMSPPR, the Bulgarian Dental Association and of the Società Italiana di Maxillo Odontostomatologia, SIMO. He is the Regent for Southern Europe of the Academy of Dentistry International, ADI. He is a fellow of the Pierre Fauchard Academy, PFA. He is the Immediate Past-President, the Officer for Foreign Affairs and a member of the Board of Lecturers of the Associazione Italiana Odontoiatri, AIO, (Italian Dental Association). He is the President of the Board of Dentistry of the Province of Cagliari, Italy, and a Delegate of the General Assembly of the National Dental Board. He is a member the National Committee for the Programming of workforce need in dentistry and dental specialization in Italy. He is an Assistant Professor of the Dental School of the Università di Cagliari, Italy and teacher in periodontal and implant surgery. He is a referee in the National Continuing Education Program in Dentistry of the Italian Ministry of Health. He is the President of the European Regional Organization of the World Dental Federation (ERO-FDI).



Uri Oron

Born in Haifa, Israel 1945.

B.Sc. and Ph.D (1977) in Biology from Tel-Aviv University . Post doctoral training at Harvard University (1977-1979) on physiology and functional morphology of skeletal muscles. Joined the academic staff of Tel-Aviv University (Faculty of Life Science) in 1977 as a lecturer.

Between 1985-86 visiting assistant professor at Department of Biology, Case Western Reserve University (research on proteoglycans expression during skeletal muscle regeneration and bone repair).

Between 1977-2000 senior scientist and consultant at Biosense Inc. (a J & J company).

From 2002 a full professor at Tel-Aviv University. At 2002-2003 a sabbatical in Photothera Inc. and University of California at San Diego, USA.

An author of more than 80 peer reviewed articles and chapters in books.

Invited speakers - Biography



Ernesto Leal Junior

Ernesto Leal Junior has bachelor degree in Physiotherapy from 2002 in Brazil. In 2004 he got his Master's degree at University of Vale do Paraiba (Univap) in Brazil, and he defended his PhD thesis in 2010 at University of Bergen (Section of Physiotherapy Science, Department of Public Health and Primary Health Care, Faculty of Medicine and Dentistry).

Dr. Leal Junior has been a lecturer in 2 Brazilian universities (Univap and University of Caxias do Sul) between February 2005 and July 2009, and is a reviewer of 4 international peer-review journals (Photomedicine and Laser Surgery, Lasers in Medical Science, Physiotherapy Research International, and Journal of Sports Sciences). His current position is with Nove Julho University in Sao Paulo, Brazil.

His expert areas of research are: Sports injuries (prevention and treatment) and rehabilitation of musculoskeletal disorders. A special interest has been developed in Low-Level Laser Therapy research for injury prevention and recovery after strenuous physical activity.

Currently Dr Leal Junior has 22 scientific papers published, 9 of then in international peer-review journals (indexed by Pubmed/Medline), and also other 2 papers accepted in international journals. He has presented 39 scientific works in National and International Congresses.



Program

Saturday 25th September

09:00	<i>Musculoskeletal Work-shop</i>		Invited speaker - Paul Bradley, USA
10:30	Coffe break		
11:00	<i>Musculoskeletal Work-shop with Hands-on</i>	<i>Dentistry Work-shop with Hands-on</i>	
12:30	Lunch		
13:30	Official Opening		
14:00	Keynote speaker - Michael R. Hamblin, Harvard University, Boston, USA "Laser and light therapy mechanisms for the biphasic dose response in biological systems"		
14:45	Basic Science	Musculoskeletal	Dentistry
	<i>Laser and Light Tissue - Interactions</i>	<i>Inflammation</i>	<i>Dentistry - Periodontics</i>
	Invited speaker - Tiina Karu, Russia	Invited speaker - Rodrigo Lopes-Martins, Brazil	Invited speaker - Gerhard Seeberger, Italy (FDI)
15:15	Free paper presentations	Free paper presentations	Invited speaker - Paul Bradley, USA
15:45			Invited speaker - Maawan Khadra, Norway
16:15	Coffe break		
18:00	End of Scientific program		
19:30	Get together party		

Sunday 26th September

8:00	Keynote speaker - Roberta Chow, Brain & Nerve Research Unit, Sydney University, Australia "Pain relief with laser therapy in neck pain"		
8:45	<i>Basic Research - Cell studies</i>	<i>Oral inflammatory conditions</i>	
	Invited speaker - Heidi Abrahamse, South Africa	Invited speaker - Rene J. Bensadoun, France	
10:30	Coffe break, Exhibition and Poster viewing		
11:00	Photodynamic Therapy - Free paper presentations (4)	Dentistry Pain treatment - Free paper presentations (4)	
12:30	Lunch, Exhibition and Poster viewing		
14:00	<i>Basic Research - Airway Inflammation</i>	<i>Musculoskeletal - Tendinopathy</i>	<i>Dentistry - Nerve disorders</i>
	Invited speaker - Flavio Aimbire, Brazil	Invited speaker - Olga Kiritsi, Greece	Invited speaker - Hans Haanaes, Norway
15:45	Coffe break, Exhibition and Poster viewing		
16:15	<i>Infarced- and Ischemic tissue</i>	<i>Musculoskeletal - Muscle damage</i>	<i>Dentistry - Postoperative</i>
	Invited speaker - Uri Oron, Israel	Invited speaker - Ernesto Leal Junior, Brazil	Invited speaker - Reza Fekrazad, Iran
17:30	End of Scientific program		
19:30	Gala dinner		

Monday 27th September

8:00	Keynote speaker - Jeffery R. Basford, Mayo Clinic, Rochester, USA, Editor: Arch Phys Med Rehab "Publishing in medical Research: Overcoming Resistance to New Ideas and Novel Findings"		
8:45	<i>Central nervous system</i>	<i>Musculoskeletal - Neck & Low Back</i>	<i>Dentistry - Bleaching, PDT and LED</i>
	Invited speaker - Juanita Anders, USA	Invited speaker - Ljubica Konstantinovic, Ser.	Invited speaker - Lucio Frigo, Brazil
10:30	Coffe break, Exhibition and Poster viewing		
11:00	<i>Nerve repair & muscle preservation</i>	<i>Dentistry - Bone repair</i>	
	Invited speaker - Stefano Geuna, Italy	Invited speaker - Nivaldo Parazotto, Brazil	
12:45	Lunch, Exhibition and Poster viewing		
14:15	<i>Musculoskeletal - Arthritis</i>	<i>Wound healing</i>	
	Invited speaker - Rodrigo Lopes-Martins, Brazil	Invited speaker - Chukuka Enwemeka, USA	
16:00	Coffe break, Exhibition and Poster viewing		
16:30	GENERAL ASSEMBLY for WALT		
19:30	Official opening ceremony by Mayor of Bergen in Håkonshallen		

Tuesday 28th September

8:00	Keynote speaker - Jan M. Bjordal, Bergen University College/University of Bergen, Norway "Development of WALT-guidelines - past and future issues"		
8:45	<i>Innovative clinical laser concepts</i>	<i>Sport Medicine and Muscle Recovery</i>	
	Invited speaker - Boris Ivandic, Germany	Invited speaker - Liisa Lakso, Australia	
10:30	Coffe break		
11:00	Awards & closing ceremony		
12:30	End of day and congress		

Sunday 26th September

8:00	Keynote speaker - Roberta Chow, Brain & Nerve Research Unit, Sydney University, Australia "Pain relief with laser therapy in neck pain"		
8:45	<i>Basic Research - Cell studies</i> Invited speaker - Heidi Abrahamse, South Africa "Low Intensity LASER Irradiation Ameliorates Stem Cell based Therapy for use in Autologous Grafts"	<i>Musculoskeletal - Work-shop</i> Work-shop LLLT in Acute pain -	<i>Dentistry / Pain treatment</i> Invited speaker - Rene J. Bensadoun, France "LLLT in cancer-therapy induced oral mucositis. A systematic review and new WALT guidelines"
9:15	Free paper presentations (4)	Work-shop LLLT in Sport Medicine - <i>Ernesto Leal Junior, Brazil</i>	Free paper presentations (4)
(9:15)	Low Intensity Laser Irradiation at a Visible Wavelength of 636 nm Positively Effects Stressed Models In Vitro - <i>N. Houreld</i>		Laser therapy as a Prevention of Oral Mucositis in Pediatrics Patients undergoing Hematopoietic Stem Cell Transplantation (HSCT) – Preliminary Results - <i>Nilza NF Lopes/ M.Chavantes</i>
(9:30)	Effects of near infrared laser therapy on the genic expression of mesenchymal stem cells from dental pulp: An in vitro study - <i>Vinicius Marchiori Silva / M. Ribeiro</i>		A home care approach of Low Intensity laser Therapy as adjuvant to prevent and treat oral complications in oncologic patients - <i>Thayse Pithon Quadros Ravazzi</i>
(9:45)	Clinical and Histomorphological Evaluation of Low Level laser Effect with Autologous Neural Undifferentiated Mesenchymal Stem Cells into injured spinal cord of rats - <i>Sharifi,D</i>		Hands-on demonstrations in common musculoskeletal disorders
(10:00)	Effect of Low-Level Laser Therapy on Mast Cells in Viability of the Transverse Rectus Abdominis Musculocutaneous Flap - <i>Carlos Pinfildi</i>	Hands-on demonstrations in common musculoskeletal disorders	Effectiveness of low intensity lasertherapy in the rapid pain reduction in patients with temporo mandibular disorders - <i>BeatrizMello</i>
(10:15)	Questions		Questions
10:30	Coffe break, Exhibition and Poster viewing		
11:00	<i>Photodynamic Therapy - Free paper presentations (5)</i>	<i>Musculoskeletal - Work-shop</i>	<i>Dentistry / Pain treatment - Free paper presentations (5)</i>
(11:00)	In Vitro Photodynamic Therapy On Co-Cultures Of Malignant Melanoma Cells And Keratinocytes With A Zinc Phthalocyanine Photosensitizer - <i>J. Jardine/H. Abrahamse</i>	Work-shop LLLT in Arthritis -	Lasers and LEDs in dentistry; A discussion of wavelength, dosage and modality - <i>Gerry Ross</i>
(11:15)	Antimicrobial photodynamic therapy of different light energy doses with Radachlorin® and Toluidine Blue O on Streptococcus mutans: an in vitro study - <i>S. Ayremlou</i>		LED Therapy for TMJ and Cervicogenic headache treatment - <i>Renata Pizzo</i>
(11:30)	Photodynamic Therapy of Unconvenient Locations in Skin Cancer - <i>E.Ph.Stranadko</i>		In vitro analysis of human tooth pulp chamber temperature after diode laser irradiation in different power output - <i>Mollo</i>
(11:45)		Hands-on demonstrations in common musculoskeletal disorders	Efficaty of LLLT in reducing orthodontic pain caused by separators - <i>A.Hassanzadeh</i>
(12:00)			Pilot study about the role of LLLT in the management of neurological Burning Mouth Syndrome. Preliminary results - <i>Del Vecchio A</i>
(12:15)	Questions		Questions
12:30	Lunch, Exhibition and Poster viewing		

	<i>Basic Research - Airway Inflammation</i>	<i>Musculoskeletal - Tendinopathy</i>	<i>Dentistry - Nerve disorders</i>
14:00	Invited speaker - Flavio Aimbire, Brazil "LLLT effects on inflammatory airway disorders"	Invited speaker - Olga Kiritsi, Greece "LLLT for plantar fasciitis"	Invited speaker - Hans Haanaes, UiO, Norway "Therapeutical effects of LLLT in trigeminal nerve lesions"
14:30	Free paper presentations (4)	Free paper presentations (4)	Free paper presentations (4)
(14:30)	Attenuation of cholinergic hyperreactivity, β_2 -adrenergic hyporesponsiveness and TNF- α mRNA expression in rat bronchi segments in E. coli LPS-induced airway inflammation by a NF- κ B dependent mechanism - <i>F. M. de Lima/ F Aimbire</i>	Effect of LLLT (810nm) on the tissue properties and inflammatory markers the experimental model of tendinitis in rats - <i>Labat Marcos, Rodrigo</i>	Use of Low Level Lasers in the treatment of Neuropathic Pain in the Trigeminal Nerve - <i>Gerry Ross</i>
(14:45)	Phototherapy reduces the hyperreactivity and hyporeactivity of airway smooth muscle segments to cholinergic agonist in a lung inflammation model induced by intestinal reperfusion ischemia in rat - <i>F. Aimbire</i>	LLLT reduces PGE2 concentration in Achilles tendinopathies - <i>Jan Magnus Bjordal</i>	Laser phototherapy in the treatment of Trigeminal neuralgia: Addressing clinical protocol - <i>Daiane Thais Meneguzzo</i>
(15:00)	Low Level Laser Therapy (LLLT) in treatment of Asthma, added to conventional drug therapy (crossover, case - control clinical trial) - <i>Vatankhah Zohreh</i>	Realignment and Collagen changes with low level laser therapy combined with low intensity ultrasound in calcaneous tendon healing - <i>Carlos Pinfildi</i>	A pilot study in alveolar nerve injury after surgical removal of third molar - <i>Lado Loko Loro</i>
(15:15)	Low Level Laser Therapy in caudal epigastric artery increase angiogenesis and vascular endothelium growth factor on TRAM flap survival - L. M. <i>Ferreira</i>	Anti-inflammatory effects of LED therapy on Achilles tendinitis in rats - <i>Flavio Aimbire</i>	The Effect of Low Level Laser Therapy on Periodontal Ligament Orthodontic Movement in Rats - <i>N. Cordeiro/M. Chavantes</i>
(15:30)	Questions	Questions	Questions
15:45	Coffe break, Exhibition and Poster viewing		
16:15	Invited speaker - Uri Oron, Israel "Low level laser therapy in infarcted and ischemic tissue"	Invited speaker - Ernesto Leal Junior, Brazil "LLLT effects in progressive treadmill-running: exercise performance, oxidative stress and muscle damage"	Invited speaker - Reza Fekrazad, Iran "LLLT for postoperative pain after oral surgery. A systematic review and new WALT guidelines"
16:45	Free paper presentation (2)	Free paper presentation (2)	Free paper presentation (2)
(16:45)	Effects of light emitting diode irradiations on changes of growth factors in the fetal mouse blood - <i>Youngjong Ko</i>	Influence of Low Level Laser Therapy protocol on edema treatment and prevention - <i>Daiane Thais Meneguzzo</i>	Low-intensity laser therapy for accelerating root formation of rat molars: Mammographic survey - <i>Lida Toomarian</i>
(17:00)	The antithrombic effect of InGaAlP laser blood irradiation: A preliminary clinical study - <i>Insoo Jang</i>	Which properties are important for a phototherapy device, either to buy it or to perform scientific studies: power? Power density? Beam properties? Coherence? Wavelength? - <i>Hans A. Romberg</i>	Low-intensity laser therapy for accelerating root formation of rat molars: (Histological evaluation) - <i>Nikoo Tadayon</i>
(17:15)	Questions	Questions	Questions
17:30	End of Scientific program		
19:30	Gala dinner		

Monday 27th September

8:00	Keynote speaker - Jeffrey R. Basford, Mayo Clinic, Rochester, USA, Editor: Arch Phys Med Rehab "Publishing in Medical Research: Overcoming Resistance to New Ideas and Novel Findings"		
8:45	<i>Central nervous system</i> Invited speaker - Juanita Anders, USA "Light Therapy for Treatment of Central Nervous System Injury"	<i>Musculoskeletal - Neck & Low Back</i> Invited speaker - Ljubica M. Konstantinovic, Serbia "Low-Level Laser Therapy for Acute Low Back and Neck Pain with Radiculopathy"	<i>Dentistry - Photobleaching, PDT and LED</i> Invited speaker - Lucio Frigo, Brazil "Rat Tooth Pulp Analysis of Photoactivated Dental Bleaching Using LED and Low-Level Laser"
9:15	Free paper presentations (4)		Free paper presentations (4)
(9:15)	Evaluation of low level LASER-therapy and chemical therapy on spinal cord injury in rats (An experimental and histomorphometric study) - <i>Arash Farzan</i>	Comparison of two different energy doses of low level laser therapy for acute lumbar radiculopathy due to disc herniation - <i>M.Jovicic</i>	New Modality of PDT "Trojan Horse" in Oral &Maxillofacial Tumors - <i>Katayoun AM Kalhori</i>
(9:30)	Neuroendoscopic Nd:YAG Laser stereotaxis to treat colloid cysts into the third ventricle - <i>M. Cristina Chavantes</i>	Low Intensity Laser Therapy on side effects of chemotherapy and/or radiotherapy in head and neck cancer - <i>Helga Ferreira</i>	Study for development of clinical protocols using LED-therapy - <i>R. F. Z. Lizarelli</i>
(9:45)	Mitochondrial responses to light therapy in cell culture models of Parkinson's disease - <i>P. A. Trimmer</i>	Low Level Laser Therapy in chronic pain in Juvenile-onset spondyloarthritis - <i>Laura Marinela Alilioie</i>	Is there really a threshold observed in the dose-effect relationship for laser and LED phototherapy? - <i>Hans A. Romberg</i>
(10:00)	Effect of 650 nm and 808 nm laser irradiation on sensory and motor nerve conduction – implications for analgesic effects of LLLT - <i>Roberta Chow</i>	A Novel Concept of Chronic Pain Mechanisms and Effective Pain Treatment with Multimodality Low Energy Photonic and Laser Therapy (LEPT) - <i>Natasha Salansky</i>	
(10:15)		The effects of infrared laser therapy and weightbath traction hydrotherapy in cervical discopathy - <i>Csaba Oláh</i>	
10:30	Coffe break, Exhibition and Poster viewing		
11:00	<i>Peripheral nerve injuries and repair</i> Invited speaker - Stefano Geuna, Italy " Current concepts in tissue-engineering of peripheral nerve injuries"	<i>Dentistry/skeletal- Bone repair</i> Invited speaker - Nivaldo Antonio Parazotto "Low Level Laser Therapy Improve Bone Repair in Osteoporotic Rats"	
11:30	Free paper presentations (4)		Free paper presentations (4)
(11:30)	Phototherapy for Preservation of Denervated Muscle in Complete Peripheral Nerve Injury - <i>Shimon Rochkind</i>	Comparative study of the effects of low- intensity pulsed ultra-sound and low level laser therapy on bone defects in tibias of rats - <i>Ana Claudia Muniz Renno</i>	
(11:45)	Low Level Laser Therapy in painful neuroma refractory to conventional treatment in amputation stumps: Pilot study <i>M.Cristina Chavantes</i>	Low Level Laser Therapy does not modulate the outcomes of a highly bioactive glass-ceramic (BIOSILICATE®) on bone consolidation in rats - <i>Ana Claudia Muniz Renno</i>	
(12:00)	Low Level Laser Therapy in postherpetic neuralgia refractory to conventional treatment: An effective response - <i>Pereira, M.H.C.</i>	Low Level Laser therapy and bone regeneration - <i>Dana Vieru York</i>	
(12:15)	Antialgic effect of low intensity laser in the treatment of cervicogenic headaches - <i>R.C.A. Pizzo</i>		
(12:30)	Questions		Questions
12:45	Lunch, Exhibition and Poster viewing		

	<i>Musculoskeletal - Arthritis</i>	<i>Wound healing</i>
14:15	Invited speaker - Rodrigo Lopes-Martins, Brazil "Pathophysiology and therapeutic avenues for LLLT in arthritis"	Invited speaker - Chukuka Enwemeka, USA Current concepts in light activated-wound healing
14:45	Free paper presentations (4)	Free paper presentations (4)
(14:45)	Laser Therapy for the treatment of Arthritic Knees: A clinical study - <i>F. Saragaa</i>	A case series of gingival depigmentation by laser: clinical findings and patients responses - <i>Martha S. Ribeiro</i>
(15:00)	Comparing the effect of low level laser therapy (LLLT) with Celecoxib in knee osteoarthritis (OA) - <i>Soheila Mokmeli</i>	Successful white hair removal after coloring using Intense Pulse Light - <i>Robabeh Alijanpour</i>
(15:15)	The effects of intravenous laser blood irradiation and individualized physical therapy in Juvenile Arthritis - <i>Laura Marinela Ailioaie</i>	Low-level laser therapy at 635 and 670 nm for treatment of excisional and incisional skin wounds in a rat model - <i>Peter Gál</i>
(15:30)	Physical therapy protocol with sensory motor training and associated with cluster diode laser in patients with knee osteoarthritis - <i>Carlos Pinfildi</i>	Changes in laser-tissue interactions on a wide spectrum of power densities ended close to high power - <i>Majlesi</i>
(15:45)	Questions	Questions
16:00	Coffe break, Exhibition and Poster viewing	
16:30	GENERAL ASSEMBLY for WORLD ASSOCIATION for LASER THERAPY	
19.30	Official welcoming ceremony by the Mayor of Bergen in Håkonshallen	

Tuesday 28th September

8:00	Keynote speaker - Jan M. Bjordal, Bergen University College/University of Bergen, Norway "Development of WALT-guidelines - past and future issues"	
	<i>Innovative clinical laser concepts</i>	<i>Sport Medicine and Muscle Recovery</i>
8:45	Invited speaker - Boris Ivandic, Germany "Applications of low-level laser treatment in ophthalmology"	Invited speaker - Liisa Lakso, Australia Low Level Laser Therapy in Sports Medicine
9:15	Free paper presentations (4)	
(9:15)	Low-level Laser Therapy in Chronic Autoimmune Thyroiditis: Initial Results - <i>M C Chavantes</i>	Comparison between light emitting diode therapy (LEDT) and cold water immersion therapy (CWIT) in short-term recovery of biochemical markers related to skeletal muscle restitution after high-intensity exercise in athletes: A pilot study - <i>Ernesto Leal Junior</i>
(9:30)	Photobiostimulation and Self-organization Phenomena at Cellular Level in Medical Conditions - <i>Laura Marinela Aillioie</i>	The Effect of LLLT (810 nm) on inflammatory cytokines after controlled muscle strain in the tibial muscle of rats - <i>Luciano Ramos / Lopes-Martins</i>
(9:45)	Can Low Level Laser Therapy relieve excruciating pain caused by ventriculoperitoneal shunt ? - <i>M.C. Chavantes</i>	Effects of Low-Level Laser Therapy (LLLT) in the Development of Exercise-Induced Skeletal Muscle Fatigue and Changes in Biochemical Markers Related to Post-Exercise Recovery - <i>Ernesto Leal Junior</i>
(10:00)	Low Level Laser Therapy as a new option for treating chronic pain in sternotomy after cardiac surgery - <i>M.C. Chavantes</i>	A systematic review of LLLT in acute soft tissue injuries - <i>Jan M. Bjordal</i>
(10:15)	Questions	Questions
10:30	Coffee break	
11:00	Awards - Closing ceremony	
12:30	End of day - Departure	



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Keynote speaker

"Low level laser (light) therapy: mechanisms for the biphasic dose response in biological systems"

Michael R Hamblin, PhD

Associate Professor, Department of Dermatology, Harvard Medical School
Principal Investigator, Wellman Center for Photomedicine, Massachusetts General Hospital
Member of Affiliated Faculty, Harvard-MIT Division of Health Sciences and Technology

Low-level laser (light) therapy (LLLT) has been known for almost as long as the laser itself (celebrating its 50th birthday this year). Despite a growing number of positive basic-science, pre-clinical and clinical studies, the use of LLLT remains controversial. Two main reasons for this lack of acceptance are; (A) the biochemical mechanisms underlying the positive effects are incompletely understood, and (B) the complexity of rationally choosing amongst a large number of illumination parameters such as wavelength, fluence, power density, pulse structure and treatment timing has led to the publication of a number of negative studies as well as many positive ones. In particular a biphasic dose response has been frequently observed where stimulation of biological processes occurs at relatively low levels of energy density or power density, and that the positive effect diminishes as the dose is increased, and eventually inhibitory effects predominate leading to worsening of clinical conditions. The Arndt-Schulz curve is frequently used to describe this biphasic dose response that is well known in the field of radiation and toxicology hormesis. Increasing knowledge of the molecular and cell biology pathways responsible for the effects of LLLT has now shed "light" on the reasons for this biphasic dose response. Two direct cellular mediators of LLLT have a "Janus" character: providing positive signaling at low doses and causing cytotoxicity at high doses; these are nitric oxide and reactive oxygen species. Moreover mitochondrial overstimulation can cause apoptosis via cytochrome c release. Small amounts of cellular stress can induce expression of protective genes through activation of specific transcription factors such as NF- κ B and AP-1. Mitochondrial inhibition can be responsible for pain relief by reducing axonal transport in neurons. LLLT may be both anti-inflammatory and pro-inflammatory depending on the particular cell type responding to light.

(Brown)

Basic Science

25B1445 Karu

Invited speaker

Cellular action spectra and mitochondrial mechanisms of laser phototherapy.

Tiina I. Karu

Institute of Laser and Information Technologies of Russian Academy of Sciences,
Troitsk 142190, Moscow Region, Russian Federation

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. Seven action spectra for the stimulation of DNA and RNA synthesis rate and cell adhesion to glass matrix are analyzed by curve fitting, followed by deconvolution with Lorentzian fitting. The peak positions are between 613.5 nm and 623.5 nm in the red maximum. The far-red maximum has exact peak positions between 667.5 and 683.7 nm in different spectra. Two near infrared maxima have peak positions in range 750.7-772.3 nm and 812.5-846.0 nm, respectively. So, in the wavelength ranges important for phototherapy (600-860 nm) there are four "active" regions. The terminal respiratory chain oxidase in eukaryotic cells (cytochrome c oxidase) is believed to be the photoacceptor molecule. The irradiation causes a (transient) reduction of cytochrome c oxidase. At least four types of reactions can occur with the participation of the photoacceptor molecule after its electronic excitation: changes in redox properties and the acceleration of electron transfer, one-

electron auto-oxidation ($O_2^{\bullet-}$ formation), photodynamic action (1O_2 formation), and changes in biochemical activity induced by the local transient heating of the absorbing chromophores. A novel mitochondrial light-activated cellular signaling pathway between mitochondria and cell nucleus (retrograde signaling) has been discovered and investigated. Cytochrome c oxidase can work as a signal generator as well as a signal transducer in irradiated cells.

25B1515 Ribeiro

Abstract presentation

Title: Study of the light parameters on cell cultures following low intensity red laser therapy.

Author(s): Martha Simões Ribeiro¹, Daniel Ranzani da Costa¹, Renato Araújo Prates¹, Daiane Thaís Meneguzzo¹, Silvia Cristina Núñez¹, Marcia Martins Marques². ¹ Centro de Lasers e Aplicações IPEN - CNEN\SP, Brazil. ² Departamento de Dentística- Faculdade de Odontologia\USP-SP, Brazil.

Background and objective: Low intensity laser radiation has been used in life sciences to improve cellular and tissue functions. The purpose of this study was to analyze the proliferation of prokaryotic and eukaryotic cells, using Escherichia coli and fibroblasts cells models after low intensity red laser irradiation with different parameters.

Methods: To study energy density, five groups were established using a red laser ($\lambda = 660\text{nm}$): the control group (GC) not irradiated; G(1-10)- fluence of $1\text{J}/\text{cm}^2$ and power (P) 10mW; G(4-10) fluence of $4\text{J}/\text{cm}^2$ and P= 10mW; G(1-40) fluence of $1\text{J}/\text{cm}^2$ and P= 40mW; G(4-40) fluence of $4\text{J}/\text{cm}^2$ and P= 40mW. To study exposure time, the groups were: control group (GC) where the cells was not irradiated; G(100-10)- t= 100s and P= 10mW; G(400-10)- t=400s and P=10mW; G(100-40)- t=100s and P= 40mW; G(400-40)- t=400s and P=40mW. This study was performed in three different days every time in triplicate and the results were submitted to statistical analysis; both prokaryotic and eukaryotic cells were tested in all conditions.

Results: The results suggest a highest biostimulation in groups G4-40 and G400-10 whereas G40-4 showed the lowest cell proliferation.

Conclusion: These findings indicate that the parameters fluence, fluence rate and exposure time are equally important on the regulation of the proliferate function of prokaryotic and eukaryotic cells.

25B1530 Dyson

Abstract presentation

Title: The role of the circulation in the spatial and temporal amplification of the effects of photons on injured tissue: an analysis of current knowledge.

Authors: Mary Dyson PhD FCSP(Hon), King's College London (KCL) UK and Salah E O Elsayed PhD FRCS, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia.

Abstract: Photon-induced changes in the microcirculation and macrocirculation reported recently may be involved in the therapeutic effects of low level light (including laser) therapy (LLLT). The effects of photon absorption may be amplified by changes in immune (inflammatory) cells and regulatory proteins while in transit through the dermal capillaries. Located just beneath the epidermis in the papillary layer of the dermis, their cellular and molecular contents are readily accessible to photons during LLLT, as are their endothelial cells and pericytes, all of which can be affected directly by photons.

Cytokines and other regulatory proteins are secreted by inflammatory and other cells located in the epidermis, and in the extravascular and intravascular components of the dermis, in response to injury and during tissue repair, the progress of which they control. Evidence will be provided that these proteins, secreted by cells as a direct response to photon absorption, can initiate indirect responses in cells that have not absorbed photons when they reach them via the circulating blood. This provides a mechanism whereby the effects of LLLT can be amplified spatially and temporally. In consequence, treatment duration is a clinically important parameter. Within the therapeutic range of power and duration, the longer the duration, the greater the number of circulating cells and regulatory molecules that can be affected directly by photons while in transit through the dermal capillaries, and the greater the clinical effectiveness of LLLT on the repair of injured tissues.

25B1545 Karsten / Smit

Abstract presentation

Title: Experimental phantom verification studies for simulations of light interactions with skin.

Author(s): Karsten, A.E., Singh A. - CSIR National Laser Centre, Pretoria, South Africa,

Background and objective: What was the major reason for doing this study?

The interaction of laser light with human skin is an area of continuous research due to non-invasive light based techniques gaining momentum as diagnostic and treatment modalities. Computer models simulating, *in vivo* conditions, can be an invaluable tool to determine the laser power or fluence at a certain depth into the skin for optimum dosage requirements. In order to use such a model with confidence, it needs to be verified with experimental results.

Methods: Describe the design of the study and the methodological approach. Describe the type of subjects or measurements that were included.

ASAP software from Breault Research was used as raytracing software to trace photons through a layered structure presenting skin. In order to verify the model a two layered phantom (simulating 2 skin layers) was constructed from resin (1,2). The optical properties of the different layers were measured with an Integrating Sphere and used as input for the raytracing model to determine the fluence. The fluence calculated at the end of the model was compared with the experimentally measured fluence, using a CCD camera, at the back of the phantom.

Results: Briefly summarize the main findings. Images from the CCD camera (fluence) compared favourably with the fluence images calculated by the model, Although the fluence distribution in the two images are similar, the absolute values of the total laser power exiting the model differs.

Conclusions: What can be concluded from the results of this study? There was a good correlation between the simulated and experimentally determined fluence distribution. The discrepancies in the absolute values between the computer model and the experimental measurements may be attributed to the inaccuracies ($\pm 10\%$) in determining the optical properties of the different layers in the phantom.

25B1645 Laakso

Abstract presentation

Title: Effect of 830nm laser phototherapy on olfactory neuronal ensheathing (progenitor-like) cells grown *in vitro* on bioscaffolds

Authors: E-L Laakso¹, ACM Renno² and PA McDonnell³. 1 School of Physiotherapy and Exercise Science, Griffith University, Gold Coast, Queensland, Australia; 2 Department of Bioscience, Federal University of Sao Paulo, Santos, SP, Brazil; 3 School of Biomolecular and Physical Sciences, Griffith University, Nathan, Queensland, Australia.

Background and Objective: Our group is investigating the effect of laser phototherapy on a range of cell lines seeded onto novel bioscaffolds as a potential method for assisting in tissue repair and healing. Our aim was to analyse the cell proliferation and growth characteristics of the olfactory neuronal ensheathing cells on the chosen bioscaffolds.

Methods: Olfactory lamina propria ensheathing (OLF442) cells were cultured, seeded and grown on two novel scaffolds: (1) fully crystallised bioactive glass-ceramic, and (2) modified spongin collagen matrix. Twenty-four hours after seeding of scaffolds, cells were irradiation with a single exposure of laser (830 nm continuous, 30 mW, 10 J/cm²; Smart Laser Medilase, NSW, Australia). Cell proliferation was calculated with spectrophotometry. Scanning electron micrography was utilised to visualise cell growth, migration patterns, and morphology of cells growing on the threedimensional scaffolds.

Results: Laser irradiation produced a 29% mean reduction in OLF442 cell growth on the glass-ceramic scaffold discs (mean absorbance \pm SD = 0.192 \pm 0.002) compared to control (non-irradiated) discs (mean absorbance \pm SD = 0.22 \pm 0.002). There was a 43% mean increase in OLF442 cell proliferation on the modified collagen scaffolds compared to non-irradiated control scaffolds.

Conclusion: Both scaffolds were capable of supporting OLF442 cell growth. There was a stimulatory effect of phototherapy on OLF442 cells in collagen derived scaffolds, and inhibitory effect of the same laser attributes on a glass-ceramic scaffold. The results support the potential use of laser for promoting tissue healing using bioscaffolds but the type of scaffold may affect the laser-mediated outcomes.

25B1700 Salman Yazdi

Abstract presentation

Title: Effect of 830nm diode laser irradiation on human sperm motility

Author(s): Reza Salman Yazdi*, Simin Bakhshi**, Firooz Jannat Alipoor, Mohammad Reza Akhoond, Abdol-Ali Ansary,

*Andrology Department, Reproductive Research Center, Royan Institute, ACECR, Tehran, Iran

**Iranian Medical Laser Association (IMLA)

**Swedish Medical Laser Society (SMLS)

Background and objective: sperm motility is known as an effective factor in male fertility and it depends on energy consumption. Low level laser irradiation could increase energy supply to the cell by producing of adenosine triphosphate (ATP). The purpose of this study is to evaluate how the laser irradiation affects the human sperm motility.

Methods: 22 Human semen samples were used in this study. Each sample was divided into 4 equal portions and irradiated by 830nm GaAlAs laser irradiation with varying doses as: 0 (control), 4, 6 and 10 J/cm². At the times of 0, 30, 45 and 60 minutes following irradiation, sperm motility was assessed by means of computer-aided sperm analysis (CASA) in all samples. Two additional tests (HOS and SCD tests) were also performed on the control and high irradiated groups as well.

Results: In control groups, progressive motility significantly decreased by passing of time, while those of irradiated groups remained constant or significantly increased in doses of 4 and 6 J/cm², at the times of 60 and 45 min, respectively. At the time of 30, progressive motility significantly increased in dose of 10, while at time of 45, it significantly increased in doses of 4 and 6, and at time of 60, it significantly increased in all three doses, in comparison with control groups.

Conclusion: These results suggest that irradiating human sperm with 830nm diode laser at 4, 6 and 10 J/cm² energy density doses can improve their progressive motility which may be related to increasing of energetic efficiency. The maximum effect appears on doses of 4 and 6 J/cm², and at the times of 45 and 60 minutes after irradiation.

25B1715 Kim

Abstract presentation

Title: Effects of 635nm irradiation on angiogenesis in CoCl₂-exposed HUVEC cells

Author(s): Jisun Kim¹, Wonbong Lim¹, Inae Kim¹, Hyukil Kwon¹, Youngjong Ko¹, Sangwoo Kim¹, Misook Kim¹, SeoYune Kim¹, Xiaojie Li¹, Hongran Choi¹, Okjoon Kim¹

¹Department of Oral Pathology, 2nd Stage of Brain Korea 21 for School of Dentistry, Dental Science Research Institute, Chonnam National University, Bug-Gu, Gwangju, Korea

Background and objective: It has been recognized that hypoxic / ischemic condition concerned with production of reactive oxygen species (ROS) is an important mediator of angiogenesis on wound healing process. Recently, 635nm of low level light irradiation that is used in many clinical fields is known to decrease the intracellular ROS level by photo-dissociation/detachment, followed by improving oxidative stress. The purpose of the present study was to investigate the effect of 635nm irradiation for process of angiogenesis on CoCl₂ induced HUVEC endothelial cells in vitro hypoxia model.

Methods: The present study investigated the angiogenetic effects of 635nm irradiation on MTT assay, tube formation, HIF-1, VEGF, VEGF-1 and -2 protein expression, and ROS dissociation in CoCl₂ induced HUVEC.

Results: Results showed that 635nm irradiation scavenged intracellular ROS and led the increase of VEGF and VEGFR-1 expression, resulted in improving the cell viability and tube formation.

Conclusion: Considering the mechanism of angiogenetic effects by irradiation based on the present study, 635nm irradiation could scavenge the intracellular ROS, increase VEGF and VEGFR expression, followed by acceleration of the angiogenesis on hypoxic / ischemic condition.

25B1730 Calza

Abstract presentation

Title: Low infra red laser light irradiation on cultured cells: effects on mitochondria and cytoskeleton.

¹A. Giuliani, ¹L. Lorenzini, ²M. Gallamini, ¹L. Giardino, ¹L. Calzà

¹BioPharmaNet-DIMORFIPA, University of Bologna, Italy; ²RGMD-Medical Devices Division, Genova, Italy.

Background: Considerable interest has been aroused in recent years by the well-known notion that biological systems are sensitive to visible light. We focused on the effect of pulsed light laser irradiation vis-à-vis two distinct biological models: neurite elongation under NGF stimulus on laminin-collagen substrate and cell viability during oxidative stress in PC12 cells; cytoskeleton organization and actine distribution in fibroblasts.

Methods: We used a 670 nm laser, with extremely low peak power output (3mW/cm²) and at an extremely low dose (0.45mJ/cm²). Neurite elongation was measured over three days in culture. The effect of coherent red light irradiation on cell reaction to oxidative stress was evaluated through live-recording of mitochondria membrane potential (MMP) using JC1 vital dye and laser-confocal microscopy, in the absence (photo bleaching) and in the presence (oxidative stress) of H₂O₂, and by means of the MTT cell viability assay. Plasma membrane-bounded actine was analyzed in lamellopodia of fibroblasts by immunocytochemistry and microdenditometry and cell shape by morphometry (cell body/elongation field ratio)

Results: We found that laser irradiation stimulates NGF-induced neurite elongation on a laminin-collagen coated substrate and protects PC12 cells against oxidative stress. It also decreases membrane-bound actine and the fibroblast lamelloposia (p<0.05). Irradiated cells also tend to expand the cell body also retracting elongations (p<0.05)

Conclusion: These data suggest that red light radiation protects the viability of cell culture in case of oxidative stress, as indicated by MMP measurement and MTT assay. It also stimulates neurite outgrowth, modifies actine distribution and rearranges cell shape.

(Green)

Musculoskeletal

25G1515 Carvalho

Abstract presentation

Title: The Effect of Laser Irradiation on Intramuscular absorption of Diclofenac in rat controlled muscle strain: Determination by HPLC coupled to Mass Spectrometry

Author(s): Rodrigo Leal de Paiva Carvalho¹, Maria Carla Petrellis¹, Ernesto Cesar Pinto Leal Jr¹, Jan Magnus Bjordal², Rodrigo Alvaro B. Lopes-Martins¹. 1 – Laboratory of Pharmacology and Experimental Therapeutics, Institute of Biomedical Sciences – University of Sao Paulo – SP – Brazil. 2 – Bergen University College, Institute of Physiotherapy – Bergen, Norway.

Background and objective: Tendinitis, osteoarthritis and skeletal muscle lesions are painful disorders highly common in the modern society. NSAIDs, specially diclofenac are widely used as a conservative therapy to treat such conditions besides its classical side-effects. However, topically applied diclofenac has been referred as safer than systemic drugs. Low Level Laser Therapy (LLLT) has been used as an alternative antiinflammatory tool. However, its well known that LLLT exhibits a marked vasodilator effect on local microcirculation. Here we investigate the possible effect of LLLT as an enhancer of the topically applied diclofenac in rat controlled muscle strain.

Methods: Experiments were performed on 12 wistar rats. Plasma samples were taken from 0 to 24h and concentrations of diclofenac were measured by HPLC coupled to Mass Spectrometry. Irradiation was performed immediately after application of the drug, (810nm, 100mW, 30s, 3J). Pharmacokinetic parameters of plasmatic diclofenac after its administration include area under the curve (AUC 0-24h) and Cmax.

Results: The results of the irradiated and non-irradiated groups were expressed as mean ± SD for AUC (0-24h) 1082.00± 0.44 (µg.h.ml⁻¹) and 757.00± 0.22 (µg.h.ml⁻¹) and Cmax 899.40± 0.67 (µg.h.ml⁻¹) and 755.30± 0.44 (µg.h.ml⁻¹) with significance of p <0.0001 for both parameters.

Conclusion: Laser irradiation was able to induce a significant increase in rate and extent of absorption of diclofenac applied intramuscularly.

25G1530 Lorenzini

Abstract presentation

Title: Laser acupuncture using an uLLL device: effectiveness in rat models of acute and persistent pain.

Author(s): ¹L. Lorenzini, ¹A. Giuliani, ²R. Capra, ¹L. Giardino, ¹L. Calzà. ¹BioPharmaNet-DIMORFIPA, University of Bologna, Italy; ²Bioengineering Centre “la Colletta” Hospital, University of Genova.

Background and objective. Acupuncture has long been accepted worldwide as complementary and alternative medicine. Laser acupuncture is defined as the stimulation of traditional acupuncture points with low-intensity, non-thermal laser irradiation.

Methods. In the first part of this study, we used transpositional maps from human to identify acupoints in rats and we validated these locations by measurement of the skin electrical resistance. Values of electrical resistance in five of the most used acupoints in laboratory animals (St 36, Bl 40, Bl 60, Th 5, Ki 1) have been measured for five consecutive days, three times a day (at 9.00, 13.00 and 17.00) through an ordinary point detector connected to a Digital Multimeter providing electrical resistance values. We then explored the clinical efficacy of a very low level diode laser wavelength 670 nm (Biolite LP020, RGM, Genoa, Italy), used to stimulate acupoints ST36 Zu San Li and TH5 Waiguan, on well-established experimental models of acute and persistent pain in the rat, e.g. acute inflammatory pain, muscle pain, visceral pain and neuropathic pain.

Results. We report the anti-edema and anti-hyperalgesia effects of laser acupuncture in models of acute inflammatory pain, e.g. CFA-induced inflammation and myofascial pain. We also indicate that spontaneous pain and thermal hyperalgesia are reduced in a neuropathic pain model, e.g. axotomy. On the contrary, no effects due to laser-acupuncture were observed on discomfort indices in a model of visceral pain, e.g. cystitis due to cyclophosphamide.

Conclusions. We thus provide evidences that acupoints stimulation using a very low intensity laser irradiation can control pain and edema in specific experimental conditions.

25G1645 Lars Hode

Abstract presentation

Title: How to specify the dose parameters in Laser Phototherapy research reports

Author: [Lars Hode](#)

Abstract: In the presentation of laser therapy research reports, it is very rare that the scientific physical parameters are specified in a correct way. This means that, very often a great job is done and the conclusion is more or less worthless; without correct physical parameters no firm conclusion can be drawn. Even in journals specialized in laser medicine, the parameter specification is of low quality. A study – no matter how advanced – is impossible to repeat if the parameters are not accurately enough described. Every attempt to repeat it, in order to control the result will fail – instead a new study is performed. Examples of omitted or wrongly stated parameters are: laser type, laser wavelength, output power, aperture size and form, type of pulsing (if any), polarization, description of set-up and more. I will suggest some definitions for doses and a listing of parameters that ought to be obligatory for every journal that publishes laser phototherapy articles. Handouts for the audience will be supplied.

25G1700 Hans Romberg

Abstract presentation

Title: Biphasic dose-effect relationship for laser and LED phototherapy: attempt to achieve an integrated view using a simple mathematical model in a multidimensional parameter space.

Author: Hans A. Romberg. Dr. Hans Romberg Medizintechnik, Schillerstr. 44, D 76297 Stutensee, Germany, and International Institute for Interdisciplinary Medicine, I³M, Unter der Schanz 2, D 69117 Heidelberg, Germany.

Background and objective: Biphasic behavior is often observed, if effect is plotted against dosage, dosage density, time, laser power, etc. Can an integrated view be formulated?

Methods: Some published data is looked at, as well in vitro as in vivo, and is multidimensionally modeled by simple mathematical methods. Speculations are given.

Results: Assuming one strongly amplified effect without threshold, but being saturated at higher dosages, and a competing counter effect, again without threshold, describes rather well the observed dosage dependency. However, in some cases, treatment time may be a deciding parameter, possibly more important than dosage. A multi-dimensional visualization of the biphasic behavior is presented.

Conclusion: The search for reaction mechanisms could focus on saturable amplification possibilities.

Comparison of results obtained with different parameter values requires the consideration of the multidimensionality of parameter space.

25G1715 Joensen

Abstract presentation

Title: Rat skin penetration during irradiation from 810 nm and 904 nm lasers.

Author(s): Jón Joensen and Jan Magnus Bjordal. Department of Physiotherapy, Faculty of Health and Social Science, Bergen University College, Norway, and Section for Physiotherapy Science, Department of Public Health and Primary Health Care, Faculty of Medicine, University of Bergen, Norway.

Purpose: The aim of this study is to investigate to which extent irradiation from Low-Level-Lasers penetrates skin during a treatment session.

Method: 64 skin flaps overlaying the gastrocnemius muscles on the hind legs from 32 Sprague Dawley male rats, weight 250-300 g.

Skin penetration was measured by Optical Power Meter System (Thorlabs Instruments, UK). The Optical Power Meter System consists of a PM100 Display unit with sample rate 6 Hz and accuracy $\pm 1\%$, and a S121B Silicon Sensor. S121B sensor input aperture \varnothing 9.5 mm with optical power range 500 nW – 500 mW and accuracy $\pm 5\%$ (Prod.).

Two commercially available therapeutic lasers were used for irradiation as follows: i) 810 nm wavelength laser (Thor-DD, UK), operated in a continuous mode with a mean output power (MOP) of 200 mW, spot size 0.0314 cm^2 and power density of 6.37 W/cm^2 , ii) 904 nm wavelength laser (Irradia, Sweden) operated in a pulsed mode: Peak power 20 W, pulse width 200 ns (10^{-9} s) and a frequency of 700 Hz; and with 60 mW MOP, spot size 0.0364 cm^2 and power density 1.67 W/cm^2 .

All skin flaps were irradiated with both the 810 nm laser and the 904 nm laser. Irradiation started alternately with 810 nm laser or 904 nm laser. Laser penetration through the skin was registered immediately at launch, after 10, 30 seconds, and every 30 second until 3 minutes (180 seconds).

Results: The amount of energy skin penetration with 810 nm, 200 mW MOP, continuous mode, laser was equal during an irradiation session of 150 seconds. Average amount of energy penetration was 21.5 % of energy output, ranging from 20.1% to 23.2%.

The amount of energy skin penetration with the 904nm, 60 mW MOP, pulsed mode, laser increased from 39.4% to 51.9% during an irradiation session of 150 seconds.

Conclusion: During a session of LLLT with 810 nm, 200 mW MOP, continuous mode, laser the amount of energy is equal over time. While the amount of energy penetrating skin during a session of LLLT with 904 nm, 60 mW MOP, pulsed mode, laser increased over time.

25G1730 Smit

Title: Influence of variation in melanin content on absorbance spectra of liquid skin phantoms

Author(s): ^{1,3} Smit, J.E., ¹ Karsten, A.E., ² Grobler, A.F. and ³ Sparrow, R.W.

¹ CSIR National Laser Centre, Pretoria, South Africa, ² Unit for drug development and research, North-West University, Potchefstroom, South Africa, ³ CSIR Biosciences, Pretoria, South Africa

Background and objective: Non-invasive laser-light treatment of skin disorders requires accurate skin optical property information; including the effect epidermal melanin has on the planning of skin tumour treatment parameters. Computational light propagation models can aid this process, but their accuracy depends on a thorough knowledge of cell tissue optical properties for different skin types. However, access to samples of all skin types is often limited and skin-like phantoms are used instead. The objectives of this study are to (a) compare liquid skin-like phantoms representing Skin Types I to VI experimentally and computationally and (b) determine how well these phantoms can predict wavelength dependent trends observed in real human skin.

Methods: Melanin samples at increasing concentrations were prepared from a pH ~ 7 melanin aqueous stock solution. Skin-like phantoms were prepared by addition of either Pheroid™ or Intralipid (20% fat emulsion). UV-VIS transmittance spectra of the samples were measured over the wavelength range 370 to 900 nm and compared to simulated results using the same optical parameters.

Results: Melanin only samples displayed broadband absorbance. Skin-like phantoms followed similar non-monotonic absorbance trends towards UV wavelengths, albeit at longer wavelengths than observed in real human skin. High and low concentration melanin samples interacted differently with the Pheroid™ and Intralipid respectively.

Conclusions: Comparison between experimental and computational results suggests that the phantoms may be able to represent optical characteristics of real skin. However, to verify how well these phantoms represent real skin, a comparison with skin biopsies needs to be made.

(Purple)

Dentistry

25P1700 Baptista

Abstract presentation

Title: The use of high and low power laser on oral pediatrics surgery. Case report

Author(s): Alessandra Baptista¹, Silvia Cristina Nuñez¹, Martha Simões Ribeiro¹

¹Centro de Lasers e Aplicações, IPEN-CNEN/SP, Brazil.

Background and objective: Dental lasers contribute significantly to the field of pediatric dentistry, providing a valuable resource for clinicians who perform different types of pediatric procedures, mainly during surgical events. An increasing number of general dentists are using the diode laser due to its characteristics as lower cost compared to traditional high power lasers as CO₂ and erbium lasers. This case report presents successful cases of maxillary labial frenectomy in pediatric patients associating high and low power laser.

Methods: A continuous high power laser ($\lambda=830\text{nm}$) with output power of 1.2W combined with low power laser ($\lambda=830\text{nm}$), beam diameter 0.028mm, output power 80mW and 18s per point around the surgical wound and one at the its center. After topical anesthesia, the labial frenum area was gently removed with controlled movements from mesial toward distal direction and the carbonized tissue was carefully removed with wet gauze. Immediately after total fibrotic tissue removal, the area was irradiated with the low power laser. The clinical outcome was evaluated according to clinical and patient point of view.

Results: During the surgical procedure, the lack of blood, the fewer anesthesia used and the faster performance greatly increased the compliance of the therapy. The use of low power laser promotes analgesic effects and an improved healing process, meanwhile through the patient point of view the procedure was not considered traumatic neither painful.

Conclusion: Our results indicate that for pediatric patients the surgical therapy combining high and low power infrared lasers is a less traumatic and a more efficient procedure.

25P1730 Carmen Todea

Abstract presentation

Title: Laser Doppler Flowmetry monitoring of dental pulp vitality after laser-assisted pulp capping

Author(s): Carmen Todea, Cosmin Balabuc, Mariana Miron, Laura Filip, Diana Lungeanu, Dorin Dodenciu; University of Medicine and Pharmacy of Timisoara, Romania

Background and objective: During tooth preparation or traumatic injuries, it is possible to accidentally expose the dental pulp without the involvement of microorganisms. Therefore, direct pulp capping may be indicated for maintaining pulp vitality and function. The aim of the present study is to investigate the pulpal blood flow in teeth subjected to laser-assisted pulp capping in comparison with conventional method.

Methods: This study was conducted on 30 patients receiving laser-assisted pulp capping, divided into five study groups. Teeth from laser groups underwent laser irradiation: group I Er:YAG laser (180-270 mJ); group II 980 nm diode laser (1W); group III Nd:YAG laser (1.25 W) and group IV CO₂ Laser (2W). After laser treatment, in teeth from groups I, II, III and IV calcium hydroxide was applied on irradiated capping area. In group V control, only calcium hydroxide was placed. The pulp microcirculation was recorded using Laser Doppler flowmetry immediately after exposure, at 1 and 12 weeks post-treatment. The PBF recordings displayed variation of mean PU for every tested tooth after the initial laser irradiation.

Results: The collected data showed non-significant increase of dental pulp blood flow due to the heat generated by laser irradiation as compared to the control group ($P > 0.005$). Moreover, after subsequent examinations, no changes in pulpal blood flow were noticed ($P > 0.005$).

Conclusion: Under the study conditions, laser-assisted treatment proved to be more effective than conventional approach. The results demonstrated only small changes of microcirculation within the dental pulp after laser irradiation in pulp capping, thus leading to the qualitative assessment of the treatment outcomes.

25P1715 Sousa / Chavantes

Abstract presentation

Title: LLLT Dosimetry Relevance: Experimental Study with Materials' Phantom.

Author(s): Marcelo V. P. Sousa¹, Elisabeth M. Yoshimura¹, André L. O. Ramos¹, Ana C. Magalhães¹, Marcia T. Saito¹, Liliam R. Santos², M.Cristina Chavantes². 1. Institute of Physics, University of São Paulo, São Paulo, Brazil. 2 Laser Medical Center of Heart Institute (InCor), Clinical Hospital, Medical School, Universidade de São Paulo.

Background and objective: Due to a great number of new clinical applications with Low-Level-Laser-Therapy (LLLT), the development of precise, solid, stable and low cost phantoms' skin, fat and muscle becomes extremely important, as they provide means to quantify light fluence in tissues under the skin, helping to find the best clinical dose. The aim is to get the best combination of matrix, absorber and scatters, as in a turbid medium, which simulates skin, fat and muscle tissues to build LLLT phantoms.

Methods: Matrixes of epoxy, polyester resins and paraffin were used with varied dyes' concentrations and scatters (nanoparticles-Al₂O₃) to change optical parameters. CCD camera was used to obtain transmission and scattering images of phantoms and of swine tissues illuminated by Diode laser (635 nm).

Results: The fluence of light transmitted through the sample form Gaussian shaped profiles. Light scattered at 90 degrees show an intensity profile with a steep growth followed by an exponential attenuation. The comparison of these two kinds of profiles for phantoms and swine tissue was used to evaluate the concentrations that simulate better different kinds of tissues. As nanoparticle concentration increases, transmitted intensity decreases, Gaussian width become larger and scattering peak becomes shallower. The resin with 10% concentration of Al₂O₃ simulates quite well fat tissue; the same matrix, with smaller Al₂O₃ concentration and with an absorber dye is indicated to muscle; paraffin can be used for skin simulation.

Saturday 25th of September 14:00 – 18:00

Conclusion: Thus, this study seems to be a reliable tool to aid clinicians' future with efficacy applying LLLT dosimetry.

25P1445 Seeberger

Invited speaker

"IMPLANT SUCCESS IN INFECTED SITES: A PARADIGM SHIFT WITH L.A.S.E.R. ASSISTANCE?"

Gerhard Konrad Seeberger

Abstract: Consolidated protocols which increase the success of implant surgery exist since several decades. Osseointegration and fiberintegration, taking benefit from optimized design of implant macromorphology and micro-morphology as well as from implant surface conditioning guarantee the immediate and long-term functional and aesthetic result. Healing time goes together with a period of discomfort for the patient although it has been minimized by results of research and the development of new technologies and surgical techniques. Giving the option to immediate implant and immediate and delayed function protocols, together with the benefit of L.A.S.E.R. assistance in decontamination and bio-stimulation of the implant site implant success seems to have a higher predictability. However, infection in implant sites is an exclusion criteria for implant surgery and a high risk factor for the outcome in today's scientific articles. This presentation offers a treatment protocol which leads to immediate implant success considering function, aesthetics and economic aspects in case of infected implant sites.

25P1515 Bradley

Invited speaker

The INTERACTION BETWEEN SURGICAL and THERAPEUTIC LASERS (Oral Surgery, Restorative Dentistry & Periodontology)

Paul Bradley, M.D., B.D.S., F.D.S., F.R.C.S

Currently available to the practitioner in the Orofacial region, there is a surgical Gallium Aluminium Arsenide 820 nm HLLT (HILT) Diode laser suitable for Oral Surgery and Periodontology. There is also available a therapeutic 820 nm Diode LLLT (LILT) laser for pain relief, augmentation of healing and biomodulation. How do these two versions of the same wavelength laser inter-relate. When one is using the HILT version for tissue ablation, is there a low intensity effect on the tissue bed helping pain relief and healing? Toshio Ohshiro, in Tokyo, was one of the first people to advocate this concept with his idea of the zones of laser action being like an inverted half apple (the "laser apple"). The deepest layer of this apple was a zone of Biostimulation. Ohshiro classified LLLT into 3 forms on this basis:

- 1) **Simultaneous.** Here the HILT laser has a simultaneous LILT effect on the tissues.
- 2) **Pure.** Here a LILT laser is used for the pure effects of healing and pain control.
- 3) **Combined.** In this case one HILT wavelength is used for ablation and a second different wavelength for biomodulation.

Examples of this will be discussed in the far infra-red e.g. CO₂, mid infra-red e.g. Erbium YAG and near infra-red e.g. Nd YAG, Diode. Low intensity effects may be identified by such phenomena as:

- a) Pain relief
- b) Enhanced healing
- c) Secondary dentine formation

An understanding of this concept markedly enhances the options for laser therapy in the Orofacial region.

Keynote speaker

“Pain relief with laser therapy in neck pain”

Roberta Chow

Neck pain is a common and costly condition in which pharmacological management has limited evidence of efficacy and significant side effects. The 12-month prevalence of neck pain in the general population is reported to range from 12.1% to 71.5% and in workers, from 27.1% to 47.8% across all occupations. For governments there is, therefore, an imperative to find a cost-effective non-drug option and for patients the need to improve quality of life. LLLT has been used in the treatment of neck pain for thirty years based on anecdotal reports. Our recently published meta-analysis in the Lancet firmly establishes an indisputable evidence base for the effectiveness of LLLT in this highly prevalent condition. Two trials of acute neck pain and 14 trials of chronic neck pain with 820 patients were included. In acute neck pain two trials showed a relative risk (RR) of 1.69 (95% CI: 1.22 to 2.33) for pain improvement. In chronic neck pain, 5 trials in which patients reported subjective improvement showed an RR of 4.05 (95% CI: 2.74 to 5.98) and in 12 trials pain intensity was reduced by 19.9 mm (95% CI: 10.0 to 29.7) on a 100 mm visual analogue scale. Trials provided follow-up data for 1-22 weeks after completion of treatment, with a 22.1 mm (95% CI: 17.4 to 26.7) reduction of pain. Importantly, side effects from LLLT were minor and not significantly different from placebo. We also found that 830nm or 904 nm LI, delivered to tender points on the neck, once or twice a week for an average of ten treatments were factors associated with improvement. Our not only establishes LLLT as an evidence-based therapy but suggest that the benefit is greater than other commonly used treatments and can persist for up to six months.

(Brown)

Basic Science

26B0845 Abrahamse

Invited speaker

Low Intensity Laser Irradiation Ameliorates Stem CellBased Therapy for use in Autologous Grafts

Heidi Abrahamse

Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa

Background and Objective: Adipose derived stem cells (ADSCs), isolated from adult human adipose tissue and aspirates, hold tremendous potential for cellular therapy applications since they can be harvested and multiplied efficiently and non-invasively and have pluripotential and proliferative capacity while minimising immune-incompatibility when used in autologous grafts. In addition, ADSCs have differentiation potential along the mesenchymal lineages of adipogenesis, osteogenesis, chondrogenesis and myogenesis further expanding its therapeutic potential. However, the clinical use of adult stem cells presents problems such as limited cell number, pain and morbidity upon isolation. Low intensity laser irradiation (LILI) has been shown to have a biostimulatory effect in a variety of different cell types affecting cellular characteristics including viability, proliferation, migration, protein expression and genetic integrity, while clinical effects include pain alleviation, reduction of inflammation and wound healing. Combining stem cell based therapy and LILI thus further potentiates two individually promising therapeutic treatment modalities. This paper explores recent advances in the effect of LILI on ADSCs and possible therapeutic implications.

Results and Conclusion: This paper reviews the development of ASCs as potential therapeutic interventions such as autologous grafts as well as the contribution of LILI on the maintenance of cell character and success as possible clinical therapeutic alternatives

Method: Our work has focussed on the ability of laser irradiation to proliferate adipose derived stem cells (ADSCs), maintain ADSC character and increase the rate and maintenance of differentiation of ADSCs into smooth muscle and skin fibroblast cells. In addition wavelength and fluence have also been studied and found to contribute to biostimulation. The use and application of ADSC differentiated SMCs for clinical applications using resorbable, injectable solid Polycaprolactone (PCL) microspheres as a delivery and bulking agent for clinical applications is currently being investigated and shows great promise.

26B0915 Houreld

Abstract presentation

Title: Low Intensity Laser Irradiation at a Visible Wavelength of 636 nm Positively Effects Stressed Models *In Vitro*

Author(s): N. Houreld, P. Sekhejane and H. Abrahamse. Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa.

Background and Objective: Wound healing in diabetic patients remains a complicated problem and there is a compelling need for the development of new, safe, reliable therapies. This study looked at the effect of low intensity laser irradiation (LILI) on diabetic wound healing *in vitro*.

Methods: The effect of LILI was evaluated on various cell models of human skin fibroblast cells (normal, wounded, diabetic wounded, hypoxic). Cells were irradiated at 636 nm with 5 J/cm². Cellular responses evaluated included: morphology, viability (Trypan blue and caspase 3/7), proliferation (XTT), cytotoxicity (LDH) and cytokine expression (IL-1 β and TNF- α).

Results: Stressed cells showed increased expression of IL-1 β and TNF- α , caspase 3/7 activity and cytotoxicity, and decreased proliferation compared to normal cells. Irradiation produced an increase in proliferation and viability, and a decrease in apoptosis, and pro-inflammatory cytokines (IL-1 β and TNF- α).

Conclusion: The models used are sufficient to produce measurable effects as compared to normal cells. LILI positively effects wound healing in stressed models, normalises cellular function, and directs cells into cell survival pathways.

26B0915 Silva / Ribeiro

Abstract presentation

Title: Effects of near infrared laser therapy on the genic expression of mesenchymal stem cells from dental pulp. An *in vitro* study

Author(s): Vinicius Marchiori Silva¹, Silvia Cristina Nunez¹, Luciane Hiramatsu Azevedo¹, Martha Simões Ribeiro^{1,2}

¹Mestrado Profissionalizante Lasers em Odontologia, IPEN-CNEN/SP, Brazil. ²Centro de Lasers e Aplicações, IPEN-CNEN/SP, Brazil.

Background and objective: Adult stem cell therapy is a feasible treatment that opens up a wide variety of therapeutical possibilities. The stimulatory effect of the low laser radiation over cell culture has been consistently reported on literature. The aim of our study was to investigate the effects of a near infrared laser ($\lambda = 830\text{nm}$) on the genic expression of the genes linked to differentiation of mesenchymal stem cells (MSC) to osteoblastic lineage.

Methods: Pulp stem cells were obtained from third molar teeth extracted from patients due to clinical indication. They were manipulated immediately after extraction in a sterile unit and opened to access the dental pulp chamber. The pulp tissue was then digested to separate the MSC. Samples collected from the cell population freshly extracted were analyzed by flow cytometry and the presence of MSC was confirmed. The cells were put into culture and divided into two groups: laser group (LG) that received laser radiation with 3J/cm² and 80mW of power with a beam diameter of 0.028cm. The cell cultures were irradiated in ten non-consecutive days in a total period of 21 days. A control group (CG) without irradiation was used for comparison.

Results: The results showed differences between the expression of the genes linked to cellular differentiation detected by molecular analysis RT-PCR and PCR. The results demonstrated that laser radiation on the afforded mentioned parameters promotes a faster differentiation on MSC.

Conclusion: The union of laser therapy and adult stem cell therapy may be a promising tool open new possibilities mostly on tissue engineering techniques.

26B0945 Sharifi

Abstract presentation

Clinical and Histomorphological Evaluation of Low Level laser Effect with Autologous Neural Undifferentiated Mesenchymal Stem Cells into injured spinal cord of rats

Authors: Dehghan, MM¹; Sharifi, D¹; Izadi, S¹; Pedram, MS¹; arjanmehr, H²; Nasiri, SM¹

1. Department of Clinical Sciences, Faculty of Veterinary Medicine, Center of Excellence for Studies of Animal Stem Cells University of Tehran, Tehran, Iran; 2. Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran

Purpose: The aim of the present study was to investigate the direct effect of Low Level Laser (LLL) in combination of autologous neural mesenchymal stem cells on re-establishment of functional capacity of regeneration of injured spinal cord. The use of stem cells for functional recovery after spinal cord injury will be potentiated with application of non-invasive physical modalities like laser, duely will be advocated to enhance healing and regeneration of affected spinal even peripheral nerve disorders to the rehabilitation phase. Clinical curiosity was to comparatively evaluate effect of LLL in healing and regeneration of experimental induced degeneration in spinal cord rat. The aim of this study was to evaluate the effects of LLL with of autologous undifferentiated neural stem cells on behavioral improvement in rats after inducing spinal cord injury

Methods&Material: The spinal cord was injured in 28 adult rats (4 groups of 8 rats each) with 8 to 12 weeks old by contusion using a Fogarty embolectomy catheter at the T8–T9 level of the spinal cord. Autologous MSCs (106 cells) were transplanted into the center of the developing lesion cavity, 3mm cranial and 3mm caudal to the cavity, at 7 days after induction of spinal cord compression injury in group (III). No treatment was given to group (I) used as control, whereas LLL with 780 nm and 250 mW for 15 minutes for 15 days for group (II) and with combination of stem cells in group IV. The samples was collected from the site of injured area after a month for histomorphological interpretation.

Results: At 4 weeks after transplantation, the presence of transplanted cells was detected in the spinal cord parenchyma using immunohistochemistry analysis. In all treatment groups (II, III, IV) (LLL, undifferentiated and cells with LLL), there was less cavitation than lesion sites in the control group. The Basso–Beattie–Brenham (BBB) score was significantly higher in rats transplanted with a combination of cells and LLL (IV) than in undifferentiated (III) and control rats.

Conclusion: Undifferentiating of MSCs to neuron-like cells with LLL has a very important role in achieving the best results for functional improvement.

26B1000 Pinfildi

Abstract presentation

Title: Effect of Low-Level Laser Therapy on Mast Cells in Viability of the Transverse Rectus Abdominis Musculocutaneous Flap

Authors: Carlos E Pinfildi, Richard E Liebano, Bernardo Hochman, Milvia M.M.S.S. Enokihara, Rafael C Gobbato, Lydia M Ferreira

Background and objective

To assess the effect of low-level laser therapy (LLLT) on viability of mast cells of the transverse rectus abdominis musculocutaneous (TRAM) flap. Background Data: LLLT has been recently used on the TRAM flap to stimulate mast cells

Methods: Eighty four Wistar rats were randomly divided into seven groups of 12 rats in each: group 1 (sham laser therapy); group 2 received 3 J/cm² at one point; group 3 received 3 J/cm² at 24 points;

group 4 received 72 J/cm² at 1 point; group 5 received 6 J/cm² at 1 point; group 6 received 6 J/cm² at 24 points; and group 7 received 144 J/cm² at 1 point. All experimental groups underwent LLLT immediately after TRAM surgery and on the next two following days, for three sessions in total. The percentage of the area of skin flap necrosis was calculated on the fourth postoperative day and two samples of skin were collected from each rat with a 1-cm² punch to perform mast cell evaluations with toluidine blue dye.

Results: Statistically significant differences were found in the percentage of necrosis, and higher values were seen in group 1 than in all other groups. Among groups 3–7 no statistically significant differences were found ($p < 0.292$). For mast cells, when group 1 was compared to groups 5 (6 J/cm² at 1 point) and 7 (144 J/cm² at 1 point), it had fewer mast cells.

Conclusion: LLLT at a wavelength of 670 nm was effective at reducing the necrotic area, and we found that it can stimulate mast cells growth to increase vascular perfusion.

26B1100 Jardine

Abstract presentation

Title: *In Vitro* Photodynamic Therapy On Co-Cultures Of Malignant Melanoma Cells And Keratinocytes With A Zinc Phthalocyanine Photosensitizer.

Author(s): J. Jardine and H. Abrahamse

Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa.

Background and Objective: Photodynamic therapy (PDT) involves destruction of cancer cells by activation of a light-sensitive photosensitizer within the cell. Because worldwide incidence of melanoma is increasing, and problems arise in treatment due to metastases, the development of effective treatments for skin cancer is essential. This study looks at the effects of a zinc phthalocyanine photosensitizer (Zn-PC) on co-cultures of human malignant melanoma cells and keratinocytes in vitro with 5-aminolaevulinic acid (5-ALA) as a comparison.

Methods: Melanoma cells (A349) were grown with keratinocytes (CRL 2130). Photosensitizers were tested at the following concentrations: 5 ALA at 0.5mM - 4mM; Zn-PC at 1 μ M - 10 μ M. Irradiation at 636nm and 680nm respectively was used at a fluence of 10J/cm². Biochemical cellular response assays detected proliferation (ATP assay), necrosis (LDH assay), apoptosis (Caspase 3/7 assay) and cell recovery (WST-1 assay). In addition, trypan blue cell counting was used, and cellular morphology was recorded by light microscopy.

Results: Treated cell populations were reduced by 50% with 1 μ M Zn-PC and 1mM 5-ALA. Results suggest that necrosis and apoptosis occurred with the lower concentrations of Zn-PC, whilst a smaller effect was observed with 5-ALA. Cells treated with Zn-PC took longer to recover over 72 hours. Photographs from light microscopy showed rounding up of cells and bleb formation with both photosensitizers. At higher concentrations of Zn PC, cells maintained their shape, with internal cellular structures destroyed, suggesting that another mechanism, besides necrosis or apoptosis, occurred.

Conclusion: Zn-PC is an effective new photosensitizer compared to 5-ALA for the induction of cell death in metastatic melanoma, keratinocyte co-cultures.

26B1115 Ayremlou

Abstract presentation

Title: Antimicrobial photodynamic therapy of different light energy doses with Radachlorin® and Toluidine Blue O on Streptococcus mutans: an in vitro study

Authors: S.Vahabi, R. Fekrazad, S. Ayremlou*, S. Taheri

Mailing Address: Department of pediatrics, Dental Faculty, Shahid Beheshti University of Medical Sciences, Evin, Tehran, Iran

Purpose: Streptococcus mutans is the primary odontopathogen presents in supragingival plaque and causes the oral disease known as dental caries. The aim of this in vitro study was to evaluate different energy doses

in Radachlorin® and Toluidine Blue O (TBO)-mediated photodynamic therapy on the viability of *Streptococcus mutans* and create an optimized protocol for a light dose-based bactericidal modality. **Material and Methods:** Bacterial suspensions of *Streptococcus mutans* were treated with either TBO in the presence of the light from a 20 mW diode laser, energy doses of 3, 6 j/cm² at 633 nm or Radachlorin® and light irradiation of 100 mW diode laser, energy doses of 6, 12 j/cm² at 662 nm. Those in control groups were subjected to laser irradiation alone or TBO/ Radachlorin® alone or received neither TBO/ Radachlorin® nor light exposure. Viable microorganisms were counted on mitis salivarius agar plates after overnight incubation aerobically at 37°C, 5% CO₂ and then reported as colony forming unit. **Results:** The results indicated that photosensitization by the light dose of 6 j/cm² with Radachlorin® or 3 j/cm² with TBO caused significant reduction in bacterial colony formation (p<0.05). **Conclusion:** Indeed, we concluded that Radachlorin® and TBO-mediated photodynamic therapy with low light energy doses can be more efficient in significantly killing of *Streptococcus mutans* in vitro.

26B1130 Stranadko

Abstract presentation

Title: Photodynamic Therapy of Unconvenient Locations in Skin Cancer

Author(s): E.Ph.Stranadko, M.V.Riabov, T.M.Ibragimov, State Research and Clinical Center for Laser Medicine (PHSM RF FMBA)

Background and objective: The traditional methods of skin cancer treatment are surgical excision and close-focus X-ray radiation. We are presenting our experience in photodynamic therapy (PDT) for treating inconvenient locations of skin cancer.

Methods: We treated 104 patients with skin cancer of inconvenient locations (on eyelids or periorbital areas, on auricles and on the skin of external aural canal). Primary cancer was diagnosed in 47 patients, recurrent cancer - in 57. For PDT we used Russian-made photosensitizers (Photohem, Photosense, Photoditazine and Radachlorine) and Foscan (temoporfin) made by the German "Biolitec AG" firm (Jena, Germany). For irradiation of tumors we used lasers with a wavelength that corresponded to the absorption peak of a photosensitizer: for Photohem it was 630 nm; for Photosense - 670nm, for chlorine photosensitizers (Photoditazine, Radachlorin, Foscan) it was 662 nm.

Results: The therapeutic effect was achieved in all patients. A complete resorption was observed in 77 patients (74%), 27 patients (26%) showed a partial tumor resolution. A complete resorption of primary tumors was up to 91,5% (43 out of 47 patients), and of recurrent cancer - up to 59,6% (34 out of 57 patients). 80% patients have got a good cosmetic results.

Conclusion: PDT is an alternative method of treatment for skin cancer localized on a face, auricles, which makes it possible to achieve recovery with good cosmetic results.

26B1430 Mafra de Lima

Abstract presentation

Title: Attenuation of cholinergic hyperreactivity, β_2 -adrenergic hyporesponsiveness and TNF- α mRNA expression in rat bronchi segments in E. coli lipopolysaccharide-induced airway inflammation by a NF- κ B dependent mechanism.

Authors: ¹F. Mafra de Lima Mafra, ²R. Albertini, ³F. Aimbire

¹Research and Development Institute, IP&D, Univap, Av. Shishima Hifumi, 2911, São José dos Campos, 12244-000, SP, Brazil; ²Rehabilitation Sciences Department, Centro Universitário Nove de Julho - Uninove. Rua Vergueiro, 235, SP, Brazil; ³Biomedical Engineering Institute, Unicastelo, Rod. Pres. Dutra, Km 138, São José dos Campos, 12247-040, SP, Brazil.

Background and objective: It is unknown if the decreased ability to relax airways smooth muscles in acute respiratory distress syndrome (ARDS), can be influenced by low level laser therapy irradiation. In this context, the present work was developed in order to investigate if PhT could reduce dysfunction in inflamed bronchi smooth muscles (BSM) in rats.

Methods: A controlled ex vivo study was developed where bronchi from Wistar rat were dissected and mounted in an organ bath apparatus with or without a TNF- α . In the experimental assays with the participation of TNF- α , the reactivity of BSM to cholinergic agonist or to β_2 -adrenergic agonist was analyzed. The cAMP level was also investigated in BSM bathed or not with TNF- α and treated or not with PhT. In other series of experiment, the BSM from rat were incubated with LPS in order to investigate the PhT effect on TNF- α mRNA expression in BSM.

Results: TNF- α caused cholinergic hyperreactivity and β_2 -adrenergic hyporesponsiveness when compared to respective controls. PhT administered perpendicularly to a point in the middle of the dissected bronchi with a wavelength of 655 nm and a fluence of 2.6 J/cm², partially decreased BSM hyperreactivity to cholinergic agonist, restored BSM relaxation to isoproterenol and reduced the TNF- α mRNA expression. The cAMP level diminished by TNF- α in comparison with isoproterenol was restored by PhT. An NF- κ B antagonist blocked the PhT effect on dysfunction and cAMP level in inflamed BSM.

Conclusion: The NF- κ B blocked activation seems to limit the efficiency of PhT.

26B1445 Aimbire

Abstract presentation

Title: Phototherapy reduces the hyperreactivity and hyporeactivity of airway smooth muscle segments to cholinergic agonist in a lung inflammation model induced by intestinal reperfusion ischemia in rat.

Authors: ¹F. Mafra de Lima, ²R. Albertini, ³W. Tavares de Lima, ⁴F. Aimbire

¹Research and Development Institute, IP&D, Univap, Av. Shishima Hifumi, 2911, São José dos Campos, 12244-000, SP, Brazil; ²Rehabilitation Sciences Department, Centro Universitário Nove de Julho - Uninove. Rua Vergueiro, 235, SP, Brazil; ³Institute of Biomedical Science, Department of Pharmacology, Av. Prof. Lineu Prestes, 1524, CEP: 05508-900. São Paulo, SP, Brazil; ⁴Biomedical Engineering Institute, Unicastelo, Rod. Pres. Dutra, Km 138, São José dos Campos, 12247-040, SP, Brazil.

Background and objective: Phototherapy (PhT) is a modulator of lung inflammation. Herein we investigated the PhT effect on alterations in reactivity of trachea smooth muscle (TSM) from rats submitted to lung inflammation induced by intestinal reperfusion ischemia (i-I/R).

Methods: Male Wistar rat weighting between 220-250 g were divided in 5 experimental groups being them: control (vehicle), sham, PhT, i-I/R and i-I/R plus PhT (i-I/R + PhT). The i-I/R group was submitted to ischemia of superior mesenteric artery during 45 min. After this period, the perfusion was re-established during 30 min, 2 or 4 h. After these reperfusion periods, the TSM segments were isolated and mounted into organ bath apparatus for studies cholinergic reactivity through isometric contraction measurement. For laser therapy (660 nm), the animals were irradiated on the skin over the upper bronchus at the site of tracheotomy 15 min after the initial of reperfusion with fluence of 7.5 J/cm² and potency of 30 mW during 3 min.

Results: In all time, the i-I/R presented significant alteration of TSM reactivity to MCh when compared to control group. At the time of 2 h after i-I/R the TSM reactivity to MCh was diminished when compared to respective control group. The hyperreactivity 30 min and 4 h after reperfusion was markedly reduced by PhT in comparison to respective groups. At the time of 2 h after i-I/R, the PhT was efficient in backing the reactivity for control level.

Conclusion: Independently of TSM contractile response observed after of i-I/R period, the PhT was efficient in modulating the TSM reactivity.

26B1500 Zohreh

Abstract presentation

Title: EVALUATION THE EFFECT OF LOW LEVEL LASER THERAPY (LLLT) IN TREATMENT OF ASTHMA, ADDED TO CONVENTIONAL DRUG THERAPY (CROSSOVER, CASE – CONTROL CLINICAL TRIAL)

Authors: Vatankhah Zohreh¹, Mokmeli Soheila¹, Boshbishe shaghayegh¹.

1.Laser Department of Milad Hospital, Tehran, Iran

Introduction: Bronchial asthma is a common disease, characterized by wide variations in resistance to airflow in intrapulmonary airways. LLLT is a safe, and side effects free reported method that was conducted to palliate the symptoms of asthma in some studies.

Material and methods: We investigated the effects of LLLT in asthma comparatively with conventional drug therapy .16 asthmatic subjects were enrolled in this 2-way crossover study. At first patients were treated with symphatomimetics and corticosteroids for at least 4 weeks (the control stage), after that they were evaluated by symptoms, physical examination and PFT. At second stage (interventional stage) LLLT was added to standard drug therapy with this protocol: 1- Intravenous laser therapy with 2.5 mW, 650 nm laser .2- Chest irradiation with 100mW, 980 nm in direct contact exposure .3- The acupuncture points irradiation, The patients at the end of treatment were evaluated for symptoms, physical examination and PFT again and the results of two stages were compared and analyzed by spss program.

Results: A noticeable improvement of the clinical and functional characteristics was remarked in patients. Symptoms and signs like; night dyspnea, cough, effort dyspnea, morning symptoms, discharge, and lung exams, wheezing, work absence showed a statistically significant difference ($p < 0.05$) after adding LLLT. However post nasal discharge, and PFT showed a non significant difference ($p = 0.081$ and $p = 0.03$ respectively)

Conclusions: LLLT with anti-inflammatory effects is the suitable and effective complement modality to the treatment of pulmonary diseases. Our study showed that the combination of LLLT with standard drug therapy is more effective than conventional drug therapy alone.

26B1515 Ferreira

Abstract presentation

Title: Low Level Laser Therapy in caudal epigastric artery increase angiogenesis and vascular endothelium growth factor on TRAM flap survival

Authors: Lydia Masako Ferreira, Carlos E Pinfieldi, Richard E Liebano, Michele A Nishioka, Bernardo S. Hochman

Background and objective: The LLLT has been used with the aim to improve the perfusion vascular of the skin and musculocutaneous flaps. This study evaluated the effect of low intensity laser therapy on the transverse rectus abdominis musculocutaneous flap (TRAM) viability and the importance of vascular angiogenesis and VEGF release.

Methods: Were used 84 Wistar rats that random divided in 7 groups with 12 rats in each one. The Group 1 (sham laser), group 2 received $3\text{J}/\text{cm}^2$ with 1 point, group 3 ($3\text{J}/\text{cm}^2$ 24 points), group 4 ($72\text{J}/\text{cm}^2$ 1point), group 5 ($6\text{J}/\text{cm}^2$ 1point), group 6 ($6\text{J}/\text{cm}^2$ 24 points) and group 7 ($144\text{J}/\text{cm}^2$ 1 point). All experimental groups were undergoing to LLLT immediately after the TRAM operation, and at the next two subsequent days, and so, animals underwent 3 days with applications. The percentage of skin flap necrosis area was calculated on the fourth postoperative day through the paper template method and two samples of skin were collected by a 1 cm^2 punch in order to perform blood vessels with 1A4 and VEGF evaluations.

Results: Was found statistically significant differences among necrosis percentage, and higher values were seen in Group 1, over all other values. Among Groups 3 to 7 statistically significant differences were not found, with $p < 0.292$. To VEGF evaluation the group 5 and 7 showed a significant increase when compared to another groups. The 1A4 evaluations showed that the groups 3 and 5 had a increase when compared to another groups.

Conclusion: Low level laser therapy on the fluences 6 and $144\text{J}/\text{cm}^2$ was efficient to increase the angiogenesis and VEGF on transverse rectus abdominis musculocutaneous flap (TRAM) viability in rats.

26B1645 Ko

Abstract presentation

Title: Effects of light emitting diode irradiations on changes of growth factors in the fetal mouse blood.

Author(s): Youngjong Ko¹, Hyukil Kwon¹, Wonbong Lim¹, Jisun Kim¹, Inae Kim¹, Sangwoo Kim¹, Misook Kim¹, SeoYune Kim¹, Xiaojie Li¹, Hongran Choi¹, Okjoon Kim¹

¹Department of Oral Pathology, 2nd Stage of Brain Korea 21 for School of Dentistry, Dental Science Research Institute, Chonnam National University, Bug-Gu, Gwangju, Korea

Background and objective: Light emitting diode therapy (LEDT) is known to promote cell proliferation on wound healing process. However, its mechanism and effect are still unknown. The purpose of this study is to evaluate the effect of LED irradiation on the changes of growth factors in the blood of fetal mouse.

Methods: Female and its 10 fetal mice were incubated in computer-controlled dark/white/635nm/470nm irradiation chamber (10mW/cm²). After the blood sampling at 2 and 4 weeks, mouse growth hormones, TGF- β , mouse EGF and GM-CSF were analyzed by ELISA tests, respectively.

Results: White, 635nm and 470nm irradiations led the increase of growth hormone, TGF- β and GM-CSF secretion in the mouse blood. Especially, 635nm was more effective than 470nm LED light. No significant differences could be determined when using irradiances between 470nm and white.

Conclusion: Taken together, 635nm irradiation led the promotion of mouse endocrine such as mouse growth hormone, TGF- β and GM-CSF in the blood, followed by increase of mouse growth.

26B1700 Jang

Abstract presentation

Title: The antithrombotic effect of InGaAlP laser blood irradiation: A preliminary clinical study.

Author(s): Insoo Jang

Changsoo Yang; Jisung Nam, *Department of Internal Medicine, College of Korean Medicine, Woosuk University, Jeonbuk, South Korea*; Junwon Kang, *Graduate School of Medical Science and Engineering, Korea Advanced Institute of Science and Technology(KAIST), Daejeon, South Korea*; Lakhung Kim, *Department of Neuropsychiatry, College of Korean Medicine, Woosuk University, Jeonbuk, South Korea*

Background and objective: Laser blood irradiation has been described as decreasing blood lipids levels, blood viscosity and fibrinogen in Korea. Some applications on ischaemic stroke prevention in clinical practice of traditional Korean medicine have been attempted. The goal of this preliminary study was to evaluate the effects of InGaAlP laser blood irradiation on platelet aggregation and coagulation mechanism.

Methods: We designed a single blind randomized controlled trial for patients with metabolic syndrome that be considered as a high risk state for ischaemic stroke. Aged 40-80 with metabolic syndrome (MS) were divided into two comparable groups as laser group or sham. Sham group received LED light (660 \pm 20 nm) on their superficial vein of upper arm, while Laser group received InGaAlP laser (660 nm) once a day for 50 min, 10 times within 12 days. Laser application procedure was conducted as stationary in skin contact and transcutaneous irradiation on blood vessels. InGaAlP laser was applied as output 100 mW during procedure. Sham/real laser apparatus were identical in their external shapes. Platelet aggregation was checked within 1-2 hours after sampling. The closing time was tested by Platelet Function Analyzer-100.

Results: After treatment the platelet aggregation was decreased in laser group while slightly increased in sham group. Differences of the platelet aggregation were significantly higher in laser group than sham group.

Conclusion: These findings indicate that non-invasive blood irradiation of InGaAlP laser may have effect on the platelet aggregation function of MS patients. Further studies about other low level lasers and antithrombotic effect with large numbers of subject are required.

(Green)

Musculoskeletal

26G1430 Labat Marcos

Abstract presentation

Title: Effect of LLLT (810nm) on the tissue properties and inflammatory markers the experimental model of tendinitis in rats

Author(s): LABAT MARCOS, Rodrigo⁽¹⁾; MAGDALOU, Jacques⁽²⁾; RAHOUADJ, Rachid⁽³⁾; WANG, Xiong⁽³⁾; BJORDAL JAN MAGNUS⁽⁴⁾; FRIGO, Lúcio⁽⁵⁾; LOPES-MARTINS, Rodrigo⁽¹⁾

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The tendinopathies are frequent diseases in modern society that not only affect athletes, but different professional activities. A pharmacological conventional treatment has been shown to be ineffective. The inflammatory process of the tendon is slightly evident when compared to other tissues, however, it presents cellular modifications and disorganization in collagen fibers that can provoke modifications in the mechanical properties of the tendon. The aim of this study was to investigate the effect of the low level laser therapy on inflammatory mediators (TNF α , IL10, PGE2, NK1, MMPs, TGF β and MPO) involved in inflammatory response of the tendon. Methods: After the tendinitis induction by collagenase injection in the tendon, the rats were treated with diclofenac or low level laser (Thera Lase 810nm). The amounts of TNF α , IL10, PGE2, NK1, MMPs, TGF β and MPO were evaluated and some mechanical properties of the tendon were tested using a tensiometer (Zwick/Roell). Results: The LLLT was effective in the reducing the gene expression of TNF α , PGE2, NK1, MPO, MMP3 and MMP13. On the other hand, LLLT also induced an increase in the gene expression of TGF β and IL10. The mechanical properties of the tendon were significantly better in the Laser-treated group. Our results demonstrated that LLLT was able to improve tendon tissue repair and to inhibit important inflammatory mediators.

26G1445 Bjordal

Abstract presentation

Title: LLLT reduces PGE2 concentration in Achilles tendinopathies

Author(s): J.M. Bjordal, R.A.B. Lopes-Martins, V. Iversen.

Abstract: Low level laser therapy (LLLT) has been forwarded as therapy for osteoarthritis and tendinopathy. Results in animal and cell studies suggest that LLLT may act through a biological mechanism of inflammatory modulation. The current study was designed to investigate if LLLT has an anti-inflammatory effect on activated tendinitis of the Achilles tendon in humans.

Seven patients with bilateral Achilles tendonitis (14 tendons) who had agreed to aggravate symptoms by pain-inducing activity immediately prior to the study, were included. LLLT (1.8 Joules for each of three points along the Achilles tendon with 904nm infrared laser) and placebo LLLT were administered to either Achilles tendons in a random order to which patients and therapist were blinded. Inflammation was examined by 1) mini-invasive microdialysis for measuring the concentration of inflammatory marker PGE₂ in the peritendinous tissue, 2) ultrasound with Doppler measurement of peri- and intratendinous blood flow, 3) pressure pain algometry and 4) single hop test.

PGE₂- levels were significantly reduced at 75, 90 and 105 minutes after active LLLT compared both to pre-treatment levels (p=0.026) and to placebo LLLT (p=0.009). Changes in pressure pain threshold (PPT) were significantly different (P=0.012) between groups. PPT increased by a mean value of 0.19 kg/cm² [95%CI:0.04 to 0.34] after treatment in the active LLLT group, while pressure pain threshold was reduced by -0.20 kg/cm² (95%CI:-0.45 to 0.05) after placebo LLLT.

We conclude that LLLT can be used for relief of inflammatory musculoskeletal pain as it reduces inflammation and increases pressure pain threshold levels in activity-induced pain episodes of

Achilles tendinopathy.

26G1500 Pinfildi

Abstract presentation

Title: Realignment and Collagen changes with low level laser therapy combined with low intensity ultrasound in calcaneous tendon healing

Authors: Carlos E Pinfildi , Viviane T Wood, Marco A Neves, Nivaldo A Parizoto, Bernardo Hochman, Lydia M Ferreira

Background and objective: The treatment of calcaneous tendons ruptures demands long-term rehabilitation. The ultrasound (US) and the low level laser therapy (LLLT) are the most applied and studied physical agents to treat this kind of lesions, however, only a few studies examined the combination of both physical agents. The purpose of this study is to investigate which way - individual or combined applications of the physical agents - is the best treatment for the injured tendon

Methods: A controlled laboratory study used 50 rats that underwent lesion caused by direct trauma on their Achilles tendon. The rats were randomly assigned into 5 groups: group 1 (control), group 2 (US), group 3 (LLLT), group 4 (US+LLLT) and group 5 (LLLT+US). Animals were treated for 5 consecutive days. On the 6th day after lesion, tendons were removed and assessed under polarized light microscopy. The organization of collagen fibers was detected and measured through birefringence. The collagen type predominance in the calcaneous tendons was assessed through the picrosirius analysis

Results: The group 2 (US) when compared with controls showed an increase in collagen organization ($p=0,03$). Groups 2 (US), 3 (LLLT) and 5 (LASER+US) revealed increase of the type I collagen synthesis when compared to control ($p<0.01$, $p=0.01$ and $p<0.01$, respectively). No differences were found among the treatment groups. The type III collagen did not show differences in any of the groups

Conclusion: Both physical single agents, US and LLLT and the combination of LLLT+US are effective to increase type I collagen synthesis. The US is also effective to increase collagen organization in the early healing process (5-day treatment).

26G1615 Ernesto

Invited speaker

Low-level laser therapy in progressive-intensity running exercise in treadmill: Effects on exercise performance, oxidative stress and biochemical markers related to skeletal muscle damage

Thiago De Marchi, PT^{1,2}, **Ernesto Cesar Pinto Leal Junior, Ph.D.**^{3*}, Shaiane Silva Tomazoni, PT⁴,
Celiana Bortoli¹, Rodrigo Álvaro Brandão Lopes-Martins, Ph.D.^{3,4}, Jan Magnus Bjordal, Ph.D.^{5,6},
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1 - Laboratory of Oxidative Stress and Antioxidants, Institute of Biotechnology, University of Caxias do Sul (UCS), Caxias do Sul, RS - Brazil. 2 - Laboratory of Human Movement (LMH), Sports Medicine Institute (IME), University of Caxias do Sul (UCS), Caxias do Sul, RS - Brazil. 3 - Center for Research and Innovation in Laser, Nove de Julho University (UNINOVE), São Paulo, SP - Brazil. 4 - Laboratory of Pharmacology and Experimental Therapeutics, Department of Pharmacology, Institute of Biomedical Sciences, University of São Paulo (USP), São Paulo, SP - Brazil. 5 - Section for Physiotherapy Science, Department of Public Health and Primary Health Care, Faculty of Medicine and Dentistry, University of Bergen, Bergen - Norway. 6 - Center for Evidence-Based Practice, Bergen University College, Bergen - Norway.

Objective: To evaluate the effects of LLLT in skeletal muscle fatigue and exercise performance in progressive-intensity running exercise in treadmill, oxidative stress and in biochemical markers of muscle damage in humans.

Methods: A randomized double-blind placebo-controlled crossover trial was performed with 22 untrained male volunteers. LLLT was performed 10 minutes before progressive-intensity running protocol (810 nm, 200 mW, 30 J in each site, 30 seconds of irradiation in each site), employing a multi-diode cluster (with 5 diode spots - 6 J from each spot) in 12 sites of each lower limb (6 in quadriceps, 4 in hamstrings, and 2 in gastrocnemius). Subjects performed a standardized progressive running protocol in a motor-drive treadmill until exhaustion. Pre-exercise and post-exercise measurements were taken of muscle damage (CK and LDH), antioxidant enzymes (SOD and CAT) and oxidative stress (Lipidic Peroxidation and Carbonylated Proteins). Exercise performance ($VO_{2\max}$, time to exhaustion) was also analysed.

Results: Compared to placebo LLLT, active LLLT significantly increased exercise performance ($VO_{2\max}$ - $p=0.01$, time to exhaustion - $p=0.04$), decreased change in biochemical markers of muscle damage (CK - $p=0.0004$, LDH - $p=0.0002$), antioxidant enzyme SOD ($p=0.003$) and oxidative stress (Lipidic Peroxidation - $p=0.0001$, Carbonylated Proteins - $p=0.02$). However, antioxidant enzyme CAT do not changed with active LLLT ($p=0.17$).

Conclusion: We conclude that LLLT before progressive-intensity running exercise increase exercise performance, decrease exercise-induced muscle damage and oxidative stress. We also conclude that decreasing oxidative stress is one of mechanisms involved in effects of LLLT in delaying skeletal muscle fatigue.

Keywords: LLLT, Progressive-intensity exercise, Muscle damage, Oxidative Stress.

26G1645 Meneguzzo

Abstract presentation

Title: INFLUENCE OF LOW INTENSITY LASER THERAPY PROTOCOL ON EDEMA TREATMENT AND PREVENTION

Author(s): Daiane Thais Meneguzzo¹, Rodney Pallota², Patricia de Almeida Silva², Jan Magnus Bjordal³, Rodrigo Álvaro Lopes-Martins², Martha Simões Ribeiro¹

1. Center for Lasers and Applications, IPEN-CNEN, São Paulo, Brazil

2. Laboratory of Pharmacology and Phototherapy of Inflammation - Department of Pharmacology, Institute of Biomedical Sciences – University of São Paulo-USP.

3. Section of Physiotherapy Science, University of Bergen, and Institute of Physiotherapy, Bergen University College, Bergen, Norway.

Background and objective: Low intensity laser therapy (LILT) has been demonstrated to reduce rat paw edema and leukocyte migration similarly to sodium diclofenac. Previous studies showed that the moment and local of irradiation also influence the edema prevention. This study evaluated the relation between energy and power density and compared the best irradiation moment and local of irradiation in different mouse strain.

Methods: The carrageenan (CA) acute inflammatory model was performed by a sub-plantar injection of 0,5mg/paw of CA in 100 male mice (BALB-c and C57BL/6) and the paw volume was measured using a plethysmometer before and 1 to 6h after CA. The LILT treatment was performed by a 810nm laser device, spot area of 0,028cm², varying the local (paw, inguinal lymph nodes (LN), and both), moment of irradiation (before, during and after edema evolution), energy (1 and 3 Joules) and power density (1, 2.1 and 3.5W/cm²).

Results: The edema reduction was achieved with 1J and 3.5W/cm², and by 3 Joules with all power densities tested. The preventive irradiation on LN was the best laser treatment on both mouse strain (BALB-c and C57BL/6). The paw irradiation during the edema evolution and the LN irradiation after edema evolution on BALB-c also showed to be effective on edema treatment.

Conclusion: 810nm LILT was effective on edema prevention and treatment on a protocol dependent manner, being energy, local end moment of irradiation important parameters to be considered during laser therapy.

26G1700 Hans Romberg

Abstract presentation

Title: Which properties are important for a phototherapy device, either to buy it or to perform scientific studies: power? Power density? Beam properties? Coherence? Wavelength?

Author(s): Hans A. Romberg. Dr. Hans Romberg Medizintechnik, Schillerstr. 44, D 76297 Stutensee, Germany, and International Institute for Interdisciplinary Medicine, I³M, Unter der Schanz 2, D 69117 Heidelberg, Germany.

Background and objective: Not only users, but often enough even producers of phototherapy devices do not know the basic properties of their devices. A physicists approach to the important properties to obtain medical or scientific results is presented.

Methods: The physical properties of laser and LED light is looked at from light production, via penetration into tissue, to absorption.

Results: Depending on the medical aim, different devices appear favorable. For scientific studies, the homogeneity is crucial, but poorly realized in nearly all devices. It is speculated on the effect of coherence inside the body, leading to locally inhomogeneous intensities.

Conclusion: For low level phototherapy devices to show strong effects, strong amplification inside the body's regulatory system is needed. These devices may thus be looked at as stimulating devices. Stimulation strength might be defined by comparison to regular target surrounding, thus allowing for a broad variety of optimal treatment parameter.

(Purple)

Dentistry

26P0915 Fontana Lopes

Abstract presentation

Title: Lasertherapy as a Prevention of Oral Mucositis in Pediatrics Patients undergoing Hematopoietic Stem Cell Transplantation (HSCT) – Preliminary Results

Author(s): Nilza Nelly Fontana Lopes, DDS, MSc, PhD, Rua Padre Priuli 11, São Paulo/Brazil/CEP 02559-020, Maria Cristina Chavantes MD, PhD, Marcos A A Souto, DDS, Juliana Rojz, DDS Roseane Vasconcelos Gouveia, MD Victor Gattardello Zecchin, MD Adriana Seber, MD. MSc

Background and objective: Mucositis is associated with fever, appetite and weight lost as well as needed of parenteral nutrition, possibility raise of systemic infections with longer hospital stays. Generally, the incidence of oral mucositis in patients subjected to HSCT is 76-89%. It is higher in

patients that receive chemotherapy associated with total body irradiation with RT. The study evaluate the effect of Low Level Laser Therapy (LLLT) for prevention of oral mucositis in patients undergoing HSCT.

Methods: The pilot study involved 6 patients in the Bone Marrow Transplant in Oncology Pediatric Institute (IOP / GRAACC/ UNIFESP – São Paulo, Brazil). All patients beyond the conditioning regimen received prophylaxis against graft versus host disease, infectious disease and veno-occlusive disease. A Diode laser with wavelength 660nm, P=35mW, t=10seconds, continuous mode, spot size= 600µm, E= 0.35J, Total E = 7J, were applied punctually in 20 anatomical landmarks. The lasertherapy began on the first day of pre-HSCT protocol and was applied until the D+15. During the highest degree of leucopenia period all patients were photographed. A total of 4 times a week the LLLT was applied. Results - In the study, 5 patients presented with mucositis grade 1 (mild edema and erythema), and 1 patient, who underwent to lasertherapy on D+1, presented mucositis grade 2 (inferior labial frenulum) with total regression on D +8.

Conclusion: The LLLT proved to be an effective tool with an excellent result on preventing oral mucositis with a cost-effectiveness.

26P0930 Ravazzi

Abstract presentation

Title: A HOME CARE APPROACH OF LOW INTENSITY LASER THERAPY AS ADJUVANT TO PREVENT AND TREAT ORAL COMPLICATIONS IN ONCOLOGIC PATIENTS

Author(s): Thayse Pithon Quadros Ravazzi¹, Helga Ferreira¹, Leila Soares-Ferreira^{1,2}, Leonardo dos Santos Osório³, Mariana da Silva Maia⁴, Fernando Almeida⁵, Daiane Thais Meneguzzo^{1,6}

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Background and objective: The standard treatment for cancer, radiotherapy and/or chemotherapy, can bring local and systemic complications to the patients, like pain, oral mucosite (OM), edema and xerostomia. To try to minimize these effects in patients that are unable to go to the medical service, a preventive dental approach associated with low intensity laser therapy (LILT) was performed in home care oncologic patients.

Methods: We have treated 6 patients between 50 to 73 years old with a diagnosis of squamous cell carcinoma or non-hodgkin lymphoma. The dental treatment consisted in removing acute and potential dental and periodontal foci of pathoses and performing oral hygiene orientation. The LILT was done 5 times a week to reduce pain, prevent and treat lesions, stimulate salivary glands and reduce tongue edema. The irradiation was performed with continuous diode laser (660nm and 880nm), spot area of 0,028cm², 100 mW and varying energy from 1 to 4 Joules per point (exposure time of 10 and 40 seconds per point, respectively).

Results: The combination of conventional dental treatment with LILT generally improved oral health, being effective on the prevention and treatment of oral mucosite, reduction of edema, improvement of swallowing and pain reduction. The comfort in receiving complete treatment at home was very well accepted by patients, whose weakness did not allow their daily displacement for treatment.

Conclusion: Dental treatment of oncologic patients in their residences, associated with LILT, was well accepted, improved the quality of their lives and alleviated the oral side effects of radiotherapy and/or chemotherapy.

26P0945 Zand

Abstract presentation

Title: Non-ablative, CO₂ laser Therapy (NACLТ): A new approach to relieve pain in oral mucosal lesions

Authors: Nasrin Zand^{(1)*}, Parvin Mansouri⁽²⁾, Mohsen Fateh⁽¹⁾, Leila Ataie-Fashtami⁽¹⁾, Safa Najafi⁽³⁾, Samad Rezaie Khiabanloo⁽²⁾, Gholamreza Esmaeeli Djauid⁽¹⁾, Farid Safar⁽²⁾, Arezoo Aghazadeh⁽¹⁾, Mohammadreza Alinaghizadeh⁽⁴⁾

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Background: In the series of our clinical trials about the analgesic effects of a single session of NACLТ in painful oral lesions, we evaluated the efficacy of this modern technique in reducing pain of oral lesions such as recurrent aphthous stomatitis (RAS), pemphigus vulgaris (PV), post chemotherapy mild/ moderate oral mucositis.

Material & Method: In these studies we used CO₂ laser in non-ablative manner. Before laser irradiation, a layer of transparent, non-anesthetic gel with high water content was placed on the lesions. The lesions were irradiated with CO₂ laser (10600 nm, 1 watt power in defocused continuous mode) through the gel layer. The patients reported their pain on a 10-grade visual analogue scale (VAS) before and immediately after laser therapy and daily during the follow-up periods.

Results: The pain severity declined immediately and dramatically after irradiation (p<0.001). This analgesic effect was consistent during follow-up period. The procedure itself was painless and anesthesia was not required. The results of thermometry and powermetry supported the low power nature of the NACLТ. There was no visual effect of damage to the oral mucosa such as ablation, coagulation and even erythema.

Conclusion: Our results suggest that single session of non-ablative, non-thermal CO₂ laser therapy (NACLТ) could reduce pain in RAS, oral lesions of PV, post chemotherapy mild/ moderate oral mucositis, immediately and dramatically without visible side effects.

26P1000 Mello

Abstract presentation

Title: Effectiveness of low intensity laser therapy in the rapid pain reduction in patients with temporo mandibular disorders

Author(s): Beatriz Mello¹, Daiane Thais Meneguzzo², Leila Soares Ferreira³,

¹ Dental School and Dental Research Center São Leopoldo Mandic, Campinas, São Paulo, Brazil;

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Muscular disorders and oral facial pain present a significant impact on quality of life of patients including social, emotional and psychological aspects. The elapsed time of suffering associated with the phenomena of sensitization of central and peripheral nervous system, witch can change the modulation and pain perception, justify the importance of treating this pain as a disease itself. The aim of this report is to present the effectiveness of low intensity laser therapy (LILT) in the pain control of 118 patients (84% women, aged 19-68 years old) having temporo mandibular disorders (TMD). All the patients were from Ambulatory of Oral Facial Pain of São Bernardo do Campo, Brazil and. The pain as main complaint was present in 92% of the cases. 10 sessions with 48-hour interval were done in myofascial trigger points of masseter and temporal muscles. LILT was performed punctually, with continuous diode laser (830nm, 100mW, spot size of 0.028cm²), 6 points in each muscle, following these parameters: 4J per point and exposure time of 140s per point. Visual analogue scale was used to measure pain. There was a reduction of 93% in pain levels after the first session of LILT. The results show the effectiveness of laser therapy in the rapid reduction of pain and the importance of its use in public health by making universal access to this technology to the poorer population.

26P1100 Ross

Abstract presentation

Title: Lasers and LEDs in dentistry; A discussion of wavelength, dosage and modality.

Author: Dr Gerry Ross general dental practice, Address 22 Queen St N Box 190 Tottenham ON Canada LOG 1W0.

Methods: The author will discuss and show clinical examples of the use of lasers and LEDs in numerous clinical applications: extractions, implants, soft tissue surgery, grafts, analgesia of teeth, pain control, infection nerve lesions and treatment of TMJ and facial pain.

There will be a discussion of how the author applies the principles of the Arndt-Schulz Law in determining whether stimulation or inhibition is used in the delivery of treatment.

Results: The author has been using light therapy in his practice for the past 17 years and as has found greater and greater success as the research has better defined the best dosage and wavelength.

Conclusion: Lasers and LEDs have proven to be invaluable tools in the delivery of dental care that is a win-win situation for both the dentist and patient.

26P1115 Pizzo

Abstract presentation

Title: LEDYTHERAPY FOR TMJ AND CERVICOGENIC HEADACHE TREATMENT

Author(s): R. C. A. Pizzo 2; J. G. Speciali 2; F. Dach 2; V. H. Panhoca 2; V. S. Bagnato 3; R. F. Z. Lizarelli 1. 1. NILO (Núcleo Integrado de Laser em Odontologia), Ribeirão Preto, SP; 2. Department of Neurociences, Division of Neurology, School of Medicine, Clinical Hospital of Ribeirão Preto – University of São Paulo, Ribeirão Preto, SP – Brazil; 3. Physics Institut of São Carlos, Optics Group, Biophotonics Laboratory – University of São Paulo.

Background and Objective: The low intensity laser therapy has been widely applied in pain relief or analgesia mechanism considering several clinical situations. With the advent of new LED-based (light emitting diode) light sources, the need of further clinical experiments aiming to compare the effectiveness among them is paramount.

Material and Method: Proposes an evaluation of antialgic effect to TMJs internal disorders and cervicogenic headache(CH) using two different sources of LEDs, one emitting at the spectral band of red(630 +/- 5 nm) and the other one at infrared band(880 +/- 5 nm), comparatively to a control group(780nm lasertherapy using 105,7 J/cm²). Considering TMJ, Mandibular oral aperture and pain sintomatology are being considered using appropriate equipment developed to do it. Power out put is 150mW. Fluency chosen is 24 J/cm² for each point of application. Five points are irradiated: three around TMJ, one at the anterior fibers of temporal muscle and other at the center of masseter muscle. Eight sessions of applications area done and follow up care of 7, 30 and 60 days, after the last session. Thirty patients are into treatment. Their selection was randomly for groups of treatment, resulting in 10 patients for each group (infrared LED, red LED and Placebo).

Results: Seventy per cent of all patients under both LED treatment, red and infrared, became better, considering pain sintomatology and oral aperture, showing similar results in comparison with control group. Considering CH, some clinical cases, using standardized doses and application points, are under evaluation and they are presenting improvement to pain relief.

Conclusion: Ledtherapy can be indicated to treat TMJs disorders and Cervicogenic Headache as lasertherapy, under the same parameters of wavelength and fluency.

26P1130 Mollo

Abstract presentation

Title: *In vitro* analysis of human tooth pulp chamber temperature after diode laser irradiation in different power output.

Author(s): Márcio de Alencar Mollo¹, Lucio Frigo², Giovani Marino Favero³, Rodrigo Álvaro Brandão Lopes-Martins⁴, Aldo Brugnera Junior¹. 1. Research & Development Institute, Vale do Paraíba University - São José dos Campos 12244-000, SP – Brazil; 2. Biological Sciences and Health Center, Cruzeiro do Sul University - São Paulo SP – Brazil; 3. State University of Ponta Grossa, General Biology Department, Ponta Grossa PR – Brazil; 4. Biomedical Science Institute, São Paulo University - São Paulo SP – Brazil.

Back ground and objective: *In vitro* studies provide conflicting evidences of temperature changes in the tooth pulp chamber after low-level laser irradiation of tooth surface. The aim of the present study was to perform an *in vitro* evaluation of temperature increases in human tooth pulp chamber after diode laser irradiation (GaAlAs), $\lambda=808\text{nm}$, using different power densities. *Methods:* Twelve human teeth (three incisors, three canines, three premolars and three molars) were previously sectioned in the cervical third of the root and enlarged for the introduction of a thermocouple in the pulp chamber. Teeth were irradiated with 417mW, 207mW and 78mW power outputs for 30 seconds in the vestibular surface situated approximately two millimeters from the cervical line of the crown. *Results:* The highest average increase in temperature (5,6°C) was observed in incisors of the group I (417mW) *Conclusions:* The present study showed that diode laser irradiation with wavelength of 808nm operating at 417mW power output increases the tooth pulp chamber temperature of certain dental groups, especially incisors and premolars to critical threshold values for the dental pulp (5.5°C).

26P1145 Hassanzadeh

Abstract presentation

Title: Efficacy of LLLT in reducing orthodontic pain caused by separators

Authors: L.Eslamian , R.Fekrazad ,A.Hassanzadeh.

Purpose: Low level laser therapy has been shown to produce analgesic effects in many clinical applications. The aim of this clinical study was to test the efficacy of LLLT in reducing orthodontic pain.

Materials&Methods: Separation modules were placed at the proximal contacts of maxillary or mandibular first molars in 37 patients in this double-blinded and within-subject study with placebo control. In one side of the jaw this was immediately followed by laser therapy. The tip of a 100 mW Ga-Al-As (810 nm ,2 j/cm²) laser probe was placed at the buccal gingiva directed to middle third of the roots and at lingual gingiva directed to cervical third of the roots under proximal contact of all of the teeth behind canine .The other side received placebo laser therapy. This procedure repeated 24 hours later. Pain perception was evaluated at 0, 6, 24, and 30 hours and until 7th days by the visual analogue scale.

Results: Analysis of the VAS median scores showed that teeth exposed to laser treatment had lower levels of pain as compared with those with the placebo treatment. However, nonparametric statistical analysis of the data showed that Significant pain reductions were observed with laser treatment from 6 hours after insertion of separators through day 3, but no significant differences ($p>0.05$) from the non-irradiated control side were noted thereafter.

Conclusion: LLLT reduced the prevalence of pain perception through 3rd day and the results suggest this treatment is effective in orthodontic pain reduction.

Title: Pilot study about the role of LLLT in the management of neurological Burning Mouth Syndrome. Preliminary results.

Author(s): Del Vecchio A*, Palaia G*, Tenore G*, Maggiore C°, Romeo U*. *Department of Oral Sciences EMDOLA Master Sapienza University of Rome Italy. °School of Oral Surgery University of L'Aquila Italy.

Background and objective: Burning Mouth Syndrome (BMS) is characterized by burning symptoms in tongue or other oral sites, often without clinical and laboratory signs. According to its etiology, BMS should be classified in: BMS by local factors (lfBMS), by systemic factors (sfBMS) and neurological BMS (nBMS), caused by central or peripheral nerve dysfunctions especially in taste pathway. This pilot study aims to investigate whether biostimulative effects of LLLT may enhance the symptoms of nBMS.

Methods: Twenty-five patients, 16 females 9 males, between 77 affected by nBMS, were randomly selected for LLLT and irradiated, on tongue sides along the taste pathway, by a double diode laser (Lumix2 Prodent, Italy) emitting contemporarily at 650nm and 910nm, (ED=0.53 J/cm²), twice a week for 4 weeks. Maximum and minimum pain NRS evaluation was registered before and after the whole treatment. In each case total NRS rate post-treatment was deducted to total NRS rate pre-treatment, considering positive the results over two points.

Results: All patients completed treatments confirming good compliance of LLLT. Seventeen cases (68%) showed relevant benefits with valuable NRS rate reduction. Eight cases showed no significant NRS rate differences. No symptom worsening was observed. The study resulted statistically significant (p<0.0001). Dunn test, showed no relevant differences between min NRS rates before and after treatment, but significant differences in maximum rates (p<0.05)

Conclusion: According to these results it is reasonable to suppose that LLLT may play an important role in the management of nBMS. Further investigations must clarify, by greater number of cases and placebo controls, its real effectiveness.

Department of pediatrics, Dental Faculty, Shahid
Beheshti University of Medical Sciences, Evin, Tehran, Iran

Abstract presentation

Title: Use of Low Level Lasers in the treatment of Neuropathic Pain in the Trigeminal Nerve.

Author: Dr Gerry Ross- General Dental practice. 22 Queen St N Box 190 Tottenham ON Canada L0G 1W0.

Background: This is a report of patients treated in the Author's dental practice.

The first patient suffered from an onset of severe pain in V1; the trigger point was light touch to the hairs of the eyebrow. The patient had received TMJ surgery 25 years ago.

The second patient was in an automobile accident while on Vacation and hit her maxilla against the glass which resulted in numbness of the posterior branch of V2 as well as causing referred pain to the upper molars.

The third patient had pain in his lower molars with no apparent cause for the pain. He had the first molar extracted and the pain worsened and the patient was advised the likely cause was neuropathic pain and against advice he had a second molar also extracted and the pain worsened. He finally accepted that the source of pain was not in his teeth. This case involves the treatment of V3.

In all 3 of the cases the treatment involved applying the laser (830nm-150mw) to the trigger point, the path of the nerve and the trigeminal ganglion.

The fourth case was a patient who had a lower wisdom tooth extracted and 2 weeks later he came in suffering from shingles of the V3 branch of the trigeminal nerve. The infrared laser (830nm-150mw) was applied to the extraction area and the ganglion and a red laser (660nm-50mw) was applied to the soft tissue lesions.

Methods: This is a clinical study using the patients subjective reporting.

Results: In the first case (V1) the patient received 7 treatments over 4 week with complete resolution of all symptoms. The patient reported a dramatic decrease in the frequency and severity of the symptoms after the second appointment. The patient has been stable for the past 3 years

In the second case (V2) 6 treatments were performed over 3 weeks and the referred pain and numbness were greatly improved. 3weeks was allowed for healing and at that time all sensation returned and there was no longer any referred pain. The patient has been stable for the past two years.

In the third case (V3) the patient noticed a marked improvement after the first treatment; there were two treatments the following week and the patient reported complete resolution of his pain.

In the final case of shingles the soreness of the lesions improved by the 3rd session and had healed over in 4 weeks of twice weekly treatments. There was no incidence of post herpetic neuralgia which is a common finding in cases of shingles

Conclusion: Low level lasers have proved a very useful tool in treatment of neuropathic lesions of the Trigeminal nerve.

26P1445 Meneguzzo

Abstract presentation

Title: LASER PHOTOTHERAPY IN THE TREATMENT OF TRIGEMINAL NEURALGIA - ADDRESSING CLINICAL PROTOCOL

Author(s): Daiane Thais Meneguzzo^{1,2}, Leila Soares Ferreira^{1,3}, Fernanda Cunha¹, Luiz Alexandre Thomaz¹, Paulo de Camargo Moraes¹

¹Dental School and Dental Research Center São Leopoldo Mandic, Campinas, São Paulo, Brazil

²Center of Lasers and Applications, IPEN-CNEN, São Paulo, Brazil

³University of São Paulo, Dentistry School, São Paulo, Brazil

Background and objective: Trigeminal neuralgia (TN) is a painful unilateral neuralgia of the trigeminal nerve characterized by short and intense facial pain. Many medicine and treatment methods have been used, such as carbamazepine, microvascular decompression and radiosurgery methods.

However, its efficiency varies in each patient and in many cases their side effects are not tolerated.

The aim of this work is to show successful and unsuccessful clinical cases of low intensity laser therapy (LILT) protocols.

Methods: We have treated 7 patients with 20 to 83 years old with TN diagnosed by a neurologist.

The LILT was performed twice or once a week accordingly with the patient response to the therapy.

All patients were invited to stop the medications as the LILT was being effective. The irradiation was performed over the Gasser ganglion and pain area, in a punctual way (1 point per cm²) with 3 to 8 Joules of energy, exposure time of 30 and 80 seconds per point, using a continuous diode laser (100mW of power, spot area of 0,028cm²), alternating infrared (810nm) and red (660nm) laser in a continuous (CW) or pulsed (60pps) operation mode.

Results: The clinical results after LILT showed a significantly reduction in the number of episodes and intensity of pain and provided a treatment free of medication. The overall clinical evolution showed a variable pattern of improvement, cyclical in most cases, with severe peaks of pain interspersed by long periods without symptoms.

Conclusion: LILT showed to be effective, protocol-dependent, non invasive and a no side effect therapy for trigeminal neuralgia.

26P1500 Loro

Abstract presentation

Title: Low Level Laser Treatment for Management of Peripheral Mandibular Nerve Lesions: A Pilot Study

Author(s): Loro LL, Hellem S

University of Bergen, Faculty of Medicine and Dentistry, Section for Oral Surgery and Oral Medicine, Bergen, Norway

Background and Objective: Injury to branches of the mandibular nerve may occur following a range of minor and major oral surgeries. Most injuries to the branches of mandibular nerve are transient. However, some lesions persist for longer than 6 months and can leave various degrees of disability. The aim of this study was to evaluate the use of Low level laser treatment (LLLT) in the management of longstanding (>1yr) nerve mandibular nerve lesions.

Methods: 8 adult patients, 7 females and 1 male, with peripheral nerve lesions of the trigeminal nerve referred to the section of Oral Surgery and Oral Medicine, Faculty of Dentistry, University of Bergen were offered laser treatment. All 8 patients had nerve lesions of more than 1 year's duration. The following tests were conducted: visual analogue scale for sensation and taste (lingual nerve injury), 2-point discrimination test, brush stroke directional tests, pin prick, blunt point and marking of the size and location of the affected area. Patients were evaluated before treatment and at 1, 3 and 12 months after treatment. All Patients received 15 sessions of laser treatment, 40J/cm² for inferior alveolar nerve and 20 J/cm² for lingual, mental and buccal nerves using a gallium aluminium arsenide (GaAlAs) diode laser (Photon Plus).

Results: A marked alleviation of symptoms and sensory regeneration was observed in 5/8 patients. Two patients showed no improvement. 1 showed hyperesthesia during treatment.

Conclusion: Low level laser treatment is effective in the management of some long standing sensory nerve injuries.

26P1515 Cordeiro

Abstract presentation

Title: The Effect of Low Level Laser Therapy on Periodontal Ligament Orthodontic Movement in Rats

Author(s): Joseli Maria Cordeiro¹, Kjersti Gjerde², Rodney Capp Pallota³, Rodrigo Alvaro B. Lopes-Martins³, Lucio Frigo¹

1 – Center of Biological and Health Sciences – University Cruzeiro do Sul – Sao Paulo – SP – Brazil;

2 – Dept. Clinical Dentistry – Prosthodontics, Faculty of Medicine and Dentistry - University of Bergen – Norway; 3 - Laboratory of Pharmacology and Experimental Therapeutics, ICB – University of Sao Paulo – SP – Brazil.

Background and objectives: Low-level laser (LLLT) is conquering the status of a versatile widespread therapeutic tool in health sciences, specially dentistry. In this perspective, we aimed in this work to study LLLT effect in experimentally induced tooth movement in rats.

Methods: Thirty five rats were randomly divided in two groups (irradiated, non-irradiated) and had installed an orthodontic apparatus to pull rat's first molar and a third group (n=5) non-irradiated and non orthodontic apparatus installed. Laser irradiation (As-Ga-Al, $\lambda=880\text{nm}$, 100mW) started immediately after fixing the apparatus and for three consecutive days (5J/cm²). Animals were killed after 3, 5, 7 days (n=5) and histological procedures were carried out in rat's upper jaw using picosirius and HE staining technics.

Results: LLLT induced a statistically significant reduction in cell number in compression zone of periodontal membrane in the third, fifth and seventh. Periodontal membrane traction zone experienced a statistically significant cell number increase in irradiated group on day 3. LLLT induced a statistically significant increase in collagen amount in periodontal membrane compression zone in day 3 and a later reduction in collagen content in day 7. Periodontal membrane traction zone experienced a statistically significant decrease in collagen content in day 3 and 5. Periodontal

membrane compression x traction zone comparison in the same group showed a statistically significant decrease in collagen loss in compression zone in irradiated group on day 3.

Conclusions: Our data suggests that LLLT may attenuate the accompanying inflammatory process of dental displacement and enhancing collagen turnover in periodontal membrane.

26P1645 Lida Toomarian

Abstract presentation

Title: Low-intensity laser therapy for accelerating root formation of rat molars: Mammographic survey

Authors: Lida Toomarian, Reza Fekrazad, Nikoo Tadayon

Department of pediatrics, Dental Faculty, Shahid Beheshti University of Medical Sciences, Evin, Tehran, Iran

Background and Aim: Several studies suggest the biomodulatory influence of low-intensity laser irradiation on dental tissues. The aim of this study was to investigate the acceleratory effect of GaAlAs laser irradiation on root formation of rat molars.

Method and Material: Twenty four 30-day old Wistar male rats were randomly divided into 2 groups and the root length of lower molars was determined using mammography. The first group received 3 times GaAlAs laser irradiation at a wavelength of 808nm (2 J/cm², 100 mW, 20 sec per point) into the lower molar midroot area of one side at repeated intervals of 48 hours. As a control, contra-lateral molars did not receive laser irradiation. The second group received the same treatment, except for two more times. One day post the final treatment, animals were sacrificed and root length changes were assessed by mammography.

Results: The root development was higher in both irradiated groups than the non irradiated controls ($p < 0.001$). However, root length changes in 3-time irradiated samples were almost similar to that of 5-time irradiated group ($p = 0.53$).

Conclusion: Under the conditions of this experiment, GaAlAs laser irradiation accelerated root formation of the rat molar.

26P1700 Nikoo Tadayon

Abstract presentation

Title: Low-intensity laser therapy for accelerating root formation of rat molars: (Histological evaluation)

Authors: Lida Toomarian, Reza Fekrazad, Nikoo Tadayon, Jamileh Ramezani

Mailing Address: Department of pediatrics, Dental Faculty, Shahid Beheshti University of Medical Sciences, Evin, Tehran, Iran

Background and Aim. Several studies suggest the biomodulatory influence of low-intensity laser radiation on dental tissues. The aim of this study was to evaluate histological reaction of pulpal and periapical tissues to GaAlAs laser irradiation used for accelerating root formation of rat molars.

Method and Material. Ten 30-day old Wistar male rats were randomly divided into 2 groups. The first group received 3 times GaAlAs laser irradiation at a wavelength of 808nm (2 J/cm², 100 mW, 20 sec per point) into the lower molar midroot area of one side at repeated intervals of 48 hours. As a control, contra-lateral molars did not receive laser irradiation. The second group received the same treatment, except for two more times. One day post the final treatment, animals were sacrificed and the pulp and periapical tissues were examined under light microscopy. The histological reaction frequencies of pulp oedema, secondary dentin formation, PDL fiber organization, and laminadura remodeling were recorded.

Results. The frequency of secondary dentin formation was significantly higher in the irradiation groups comparing to controls. However, there were no statistically significant differences for the other frequencies between the groups.

Conclusion. Under the conditions of this experiment, GaAlAs laser irradiation could accelerates secondary dentin formation in the absence of adverse histological reactions.

26B1615 Oron

Invited speaker

EFFECTS OF LOW LEVEL LASER THERAPY ON ISCHEMIC/INJURED ORGANS

H.Tuby, L. Maltz, V. Sorin, A. Czerniak, G. Shefer and **U. Oron**
Dept. of Zoology, Tel-Aviv University, Tel Aviv 69978, Israel.

Low-level laser therapy (LLLT) has been shown to biostimulate various biological processes. Our research was focused on the beneficial effect of LLLT application to stem cells prior to their implantation to injured skeletal muscle and the ischemic heart and effect of LLLT on stem cells in vitro. In one study it was found that LLLT enhances proliferation and receptor expression of stem cells from skeletal muscles. In another study Mesenchymal stem cells (MSCs) have been isolated from rat bone marrow and grown in culture. The cells were laser irradiated with Ga-Al-As laser (810nm wavelength), labeled with 5-Bromo-2'deoxyuridine (BrdU), and then implanted (control or laser-treated) into infarcted rat hearts. Hearts were excised three weeks later and cells were stained for BrdU and c-kit immunoreactivity. Infarcted hearts that were implanted with laser-treated cells showed a significant reduction of 53% in infarct size compared to hearts that were implanted with non laser-treated cells. The hearts implanted with laser-treated cells prior to their implantation demonstrated a 5 and 6.3-fold significant increase in cell density that positively immunoreacted to BrdU and c-kit respectively as compared to hearts implanted with non laser-treated cells. The findings of the present study provide the first evidence that LLLT can significantly increase survival and/or proliferation of MSCs post implantation into the ischemic/infarcted heart, followed by a marked reduction of scarring, and enhanced angiogenesis. In another study on the liver following excision injury it was found that application of LLLT caused a significant increase in c-kit positive stem cells in the regenerative liver.

It is concluded that LLLT attenuates cell survival, angiogenesis and number of stem cells in various organs under ischemic conditions. Thus, LLLT may be suggested as a contributing beneficial treatment in cell therapy and regenerative medicine.

26P0845 Bensadoun

Invited speaker

A systematic review with meta-analysis of low level laser therapy (LLLT) in cancer therapy-induced oral mucositis

Jan Magnus Bjordal, PhD; **Rene-Jean Bensadoun, MD**; Jan Túner, DDS; Lucio Frigo, DDS, PhD; Kjersti Gjerde, DDS; Rodrigo Alvaro Brandao Lopes-Martins, PhD

Purpose: To investigate the effect of Low Level Laser Therapy (LLLT) in cancer therapy-induced oral mucositis.

Methods: A systematic review and meta-analysis of randomized placebo-controlled trials of LLLT during chemotherapy or radiation therapy in head and neck cancer patients.

Results: We found 11 randomized placebo-controlled trials with a total of 415 patients.

Methodological: quality was 4.10 (SD +/- 0.74) on the 5 points Jadad scale, and two studies were industry-funded. There was a significant relative risk reduction for OM outbreak with LLLT at 2.45 (95% CI: 1.85 to 3.18) over placebo LLLT, but heterogeneity was present. A subgroup analysis revealed that heterogeneity was caused by one study with a very small dose (0.18 Joules). Heterogeneity disappeared (I²=16%, p=0.31) and the effect improved to 2.86 (95%CI: 2.15 to 3.82) when this trial was removed from the analysis. LLLT also reduced significantly the number of days with OM grade 2 or worse with 4.38 (95%CI: 3.35 to 5.40) days. LLLT reduced mucositis severity with a standardized mean difference of 1.33 (95% CI: 0.68 to 1.98) over placebo. All studies registered possible side-effects, but they were not significantly different from placebo LLLT.

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Conclusion: There is consistent evidence from small high quality studies that LLLT can reduce the severity, pain and duration of cancer therapy-induced OM. An optimal treatment regimen should probably cover at least six points and optimal doses for each point appear to be 3 J for red wavelengths (633-685 nm) and 6 J for infrared (780-830nm) wavelengths.

26P1400 Haanaes

Invited speaker

Therapeutical effect of LLL therapy on trigeminal nerve lesions

Hans R. Haanaes

Peripheral nerve lesions are well known risks with routine procedures in oral and maxillofacial surgery or following trauma to the oromaxillofacial region. Most nerve lesions are healed within 6-12 months without any treatment. In case of healing does not occur, several treatments can be indicated, but the result of these treatment are variable and do not have good efficacy. Removal of third molars, apicectomies, cyst removals, endodontic treatment, local anesthesia, sagittal split osteotomies may all result in nerve damage. Removal of third molars seems to represent around 80 % of the injuries to inferior alveolar and lingual nerve. Since beginning of 1990 we have treated nerve sensory aberrations with LLLT. We have used GaAlAs laser (830 nm., Photon Plus™ system from Laser Medical Systems ApS, Denmark). The first 6-7 years we used a 70 mW laser, later 150 mW and the last 10 years a 400 mW output, all delivering an output continuously. Each patient receive 20 treatments and both the first 2 pilot studies including 15 and 40 patients gave more than 70 % improvement. Later 2 studies were done as double-blind studies, even if the number of patient was small it was concluded that LLLT can improve mechanoreceptor perception in long-standing sensory aberrations. The laser pobe is held in steady and close contact with the area to be treated and always perpendicular to the surface. The laser equipment has been set to deliver 6.0 J per treatment site intraorally and 3 J per treatment site extraorally. The number of treatment sites have been increased during our 20 years of experience. The test methods will be commented during the presentation.

26P1615 Fekrazad

Invited speaker

A systematic review of post-operative pain relief by Low Level Laser Therapy (LLLT) after oral surgery

Jan Magnus Bjordal, [Reza Fekrazad](#), Jan Tuner, Vegard Vereide Iversen, Lucio Frigo, Kjersti Gjerde, Rodrigo Alvaro B. Lopes-Martins

Purpose: Low level laser therapy (LLLT) has been shown to modulate acute inflammatory processes in animal studies The purpose of this study is to investigate if these findings can be translated into clinical situations like the classical model of third molar extraction.

Materials and Methods: Systematic review of randomized controlled trials (RCT) with meta-analysis of pain (continuous data) within 0-24 hours after surgery. Methodological assessments of trials were made according to Jadad's scale. Subgroup analyses were planned for wavelength, irradiance and energy dose.

Results: The literature search yielded 9 RCTs, of which 8 RCTs with acceptable quality and a total of 658 patients reported pain data within 0-24 hours after surgery. There was a significant pain reduction from all 8 RCTs combined at 7.8 [95% CI: 4.7 to 11.0] mm measured on a 100 mm VAS. Subgroup analysis revealed no significant interaction between effect and wavelength (red/infrared)

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or irradiance. But in 3 trials administering low energy doses (0.37-0.96 Joules), the overall effect was not significantly different from placebo at 1.2 [95% CI: - 5.6 to 8.0] mm on VAS, while high energy doses (6 - 7.5 Joules) in 5 RCTs induced significant pain relief at 9.6 [95% CI: 6.5 to 13.1] mm on VAS. In one RCT, there was no significant difference between high dose LLLT and the anti-inflammatory drug diclofenac.

Conclusion: LLLT with red/infrared wavelengths and energy doses of 6 -7.5 Joules, is effective in reducing acute inflammatory pain. Future research should focus on determining optimal doses.

Monday 27th of September 09:00 – 15:30

Keynote speaker

“Publishing in Medical Research: Overcoming Resistance to New Ideas and Novel Findings”

Jeffrey R. Basford

(Brown)

Basic Science

27B0845 Anders

Invited speaker

Light Therapy for Treatment of Central Nervous System Injury

Juanita J. Anders, Ph.D.

The use of light as a neurorestorative and/or neuroprotective therapy for the treatment of injury and diseases of the central nervous system (CNS) is a novel concept that is rapidly gaining attention. My laboratory in conjunction with Drs. Waynant and Ilev of the FDA was the first to definitively show that light applied transcutaneously penetrates to the level of the spinal cord. Transmission spectra revealed that the penetration was highest through all tissue layers overlying the spinal cord between the 770 and 820 nm wavelengths. The peak transmission was at 810 nm. Further, analysis showed minimal absorption of 810 nm light by blood and water. In spinal cord injury (SCI), we have shown that 810 nm light is an effective therapy in both dorsal hemisection and contusion rodent models supporting axonal regeneration and functional recovery. Using microarray and PCR analysis, we also found that genes involved in the immune response, cellular proliferation and growth factor receptors were significantly altered by light after SCI. These data provide evidence that light exerts specific ameliorative molecular effects on the response of cells to SCI. Based on these data, 810 nm light was determined to be an effective wavelength for treatment of the CNS. Preliminary experiments in my laboratory demonstrated that continuous wave (CW) 810 nm light penetrates to the level of the spinal cord in human cadavers. However, the percent of light transmission is low and presents a challenge for translation of this therapy from the animal model to the human. This challenge can be overcome with pulsed light but efficacy of the pulsed light for SCI must be demonstrated. Recently, my laboratory compared the effects of pulsed and CW light on the rat dorsal hemisection SCI model. Both CW and Pulse groups had a statistically significant increase in total number and distance of regenerated axons compared to the Control group. At three weeks post-injury, there was a significant reduction in the angle of rotation of the foot in the LT groups. These results validate that pulsed light supports axonal regeneration and functional recovery comparable to CW light. The next step for clinical translation of this therapy is to determine the pulsed light parameters that will deliver adequate light to the depth of human spinal cord.

27B0915 Arash Farzan

Abstract presentation

Title: Evaluation of low level LASER-therapy and chemical therapy on spinal cord injury in rats (An experimental and histomorphometric study)

Authors: Reza Fekrazad, Arash Farzan, Yousef Karimi, Katayoun AM Kalhori*

Institute: AJA University of Medical Sciences, Dental Department; Flat No.12, Mooj Building, First Behestan, Pasdaran Street, Tehran, IRAN

Purpose: There have been several methods introduced to decrease the undesirable outcomes of the SCI including early prescription of IV methylprednisolone(MP) in high doses immediately after the

trauma. In addition low-level LASER-therapy has been used in some studies and an increase in functional rehabilitation and cellular regeneration has been reported. In the present study we evaluated the effectiveness of a combination therapy on rats having SCI.

Methods & Materials: There was 4 study groups(each group including 15 rats). A contusion type SCI model was produced on Equithesin-anesthetized (3ml/kg i.p.) rats at the site of the T8 spinal cord segment. The first group received low-level LASER-therapy transcutaneously immediately after the trauma and daily for 14 consecutive days. The second group received MP 30mg/kg IV 5 min, 2 and 4 h after the trauma. The third group received low-level LASER-therapy immediately after the trauma and Mp 30mg/kg IV 5min, 2 and 4 h after that. Laser-therapy followed daily in 14 consecutive days. The fourth group as a control one received no treatment. 30 days after the SCI the functional rehabilitation evaluated and then rats euthanized for the histomorphometric analysis.

Results: The functional recovery of the third group was significantly more than other groups ($p < 0.05$) in addition a greater amount of cellular regeneration was reported in histomorphometric analysis for the first and the third groups rather than others.

Conclusion: our study shows that a combination therapy by MP and LASER immediately after the SCI has a favorable effectiveness on both functional recovery and cellular regeneration in rats.

27B0930 Chanavtes

Abstract presentation

Title: **NEUROENDOSCOPIC Nd:YAG LASER STEREOTAXIS TO TREAT COLLOID CYSTS INTO THE THIRD VENTRICLE.**

Author(s): Fernando C. G. Pinto², M. Cristina Chavantes¹, Erich T. Fonoff², Manoel Jacobsen Teixeira².

¹ Medical Laser Center of Heart Institute (InCor), Clinical Hospital, Medical School, University of São Paulo. ² Neurosurgery Division of Clinical Hospital, Medical School, University of São Paulo.

Background and objective: Colloid cysts (IIIIVT CC) are benign neuroepithelial cysts located in the anterior third ventricle. The authors propose the use of Nd:YAG laser stereotactic neuroendoscopic for guided resection of the third ventricle colloid cysts.

Methods: Eleven (11) patients presented third ventricle colloid cysts and were treated by Nd:YAG laser guided with stereotactic neuroendoscopy (n=7), stereotactic endoscopy (n=3) or stereotactically guided puncture (n=1). All patients presented headache; six had papilledema, one had gait disturbance and one had third-nerve palsy. Neuroimaging showed hydrocephalus and IIIIVT CC with 14.4-mm mean diameter. The patients were followed prospectively (average 33 months, range 19–64 months). The clinical data, neuroimaging findings, hospitalization stay, outcomes and complications of the method were evaluated.

Results: After surgery all patients presented clinical and image improvement. Only two patients presented transient morbidities that were easily treated: One had diabetes insipidus that lasted for two days and was treated with a single dose of DDAVP, and another had chemical aseptic meningitis, probably due to the contact of the cyst content with the CSF. This patient was treated with antibiotics and corticosteroids with complete resolution of the problem without sequels. The other patients were discharged from the hospital 48 h after surgery.

Conclusion: The stereotactic neuroendoscopy-guided procedure with Nd:YAG laser allowed the complete removal of the third ventricle colloid cysts in all patients, without definitive morbidities, sequels or recurrence of the lesion.

27B0945 Trimmer

Abstract presentation

Title: **Mitochondrial responses to light therapy in cell culture models of Parkinson's disease**

Author(s): P. A. Trimmer Department of Neurology University of Virginia, PO Box 800394, Charlottesville, VA 22908 USA .

Background and objective: Parkinson's disease (PD), a common neurodegenerative disease with disabling motor symptoms. Mutations in nuclear genes that cause familial forms of PD interact with

mitochondria. The majority of PD cases are sporadic with no known cause. Mitochondrial dysfunction occurs in both the sporadic and familial PD.

Methods: We used human mitochondrial DNA transgenic cybrid cell lines that exhibit a range of electron transport chain (ETC) dysfunction to explore the role that mitochondrial dysfunction plays in the pathogenesis of PD. Cellular respiration was measured using an Oxygraph-2k and a XF24 extracellular flux analyzer. Axonal transport of mitochondria was also measured in differentiated PD and control (CNT) cybrid cells. 810 and 980nm lasers (Lite Cure) were used to treat PD and CNT cybrid cells.

Results: PD cybrid cells exposed to constant illumination with 810 nm light (50mW/cm² for 40 sec) showed increases in axonal transport of mitochondria, and cellular respiration. PD cybrid cells exposed to 980nm light at 15mW/cm² produced responses comparable to 810nm light. PD cybrid lines with sufficiently crippled ETC function, however, were unable to respond to either 810 or 980nm light.

Conclusion: Cybrid cell lines that express mtDNA from patients with PD exhibit a range of mitochondrial ETC dysfunction. The ability of light therapy with 810 or 980nm light to generate improved axonal transport of mitochondria and cellular respiration is linked to the degree of ETC dysfunction. Our results thus far suggest that light therapy has the potential to become a new treatment for PD and other neurodegenerative diseases characterized by mitochondrial dysfunction.

27B1000 Weixing / Chow

Abstract presentation

Title: Effect of 650 nm and 808 nm laser irradiation on sensory and motor nerve conduction – implications for analgesic effects of LLLT

Author(s): Weixing Yan, Roberta Chow and Patricia Armati. Neuroinflammation Group. Brain and Mind Research Institute. Nerve Research Foundation. University of Sydney, Australia 2050.

Abstract: Both 808 nm and 650 nm laser irradiation (LI) are used for treatment of musculoskeletal pain. The mechanism for the clinical effectiveness of LI on pain relief is not clearly understood.

Hypotheses include the “Gate Theory”, endorphin release and anti-inflammatory effects. We hypothesise that inhibition of nerve conduction is another plausible mechanism. To evaluate this we studied the effect of 650 nm (35 mW, 30s per point) and 808 nm (450 mW, 30 s per point) laser irradiation on somatosensory evoked potentials (SSEPs) and compound muscle action potentials (CMAPs) in rat sciatic nerve. Recordings of SSEPs and CMAPs were made before, and 10 min, 20 min, 24 hr and 48 hr post-LI. Transcutaneous LI was applied by firm application of the laser probe to a single point overlying the sciatic nerve or four points, three overlying the sciatic nerve and one overlying the sural nerve. Neither wavelength to a single point induced any change in latency or amplitude of SSEPs or CMAPs. 650 nm LI to 4 points significantly prolonged SSEP latencies at 20 mins and reduced amplitudes at 10 and 20 mins post-LI but returned to control values at 24 hr and 48 hr. 650 nm LI to 4 points significantly prolonged CMAP latency at 10 min, and reduced amplitude at 10 min, 20 min and 24 hours but returned to normal at 48 hrs. 808 nm to 4 points reduced latency and amplitude of SSEPs and CMAPs at 10 min, 20 min returning to baseline at 24 hr and 48 hr.

Conduction slowing in sensory reduces afferent signalling to dorsal horn neurons and downregulates activity in second order neurons, thereby modulating pain and slowing of motor fibres reduces pain associated with myofascial dysfunction. Such conduction slowing may well explain clinical analgesia with LLLT.

27B1100 Geuna

Invited speaker

Current concepts in tissue engineering of peripheral nerve injuries

Stefano Geuna

*Department of Clinical and Biological Sciences,
San Luigi Gonzaga School of Medicine, University of Turin, Italy*

Interest in the improvement of peripheral nerve repair and regeneration by means of tissue engineering is continuously increasing and, similarly to many other fields of regenerative medicine, great expectations have risen within the general public to its potential clinical application in the treatment of damaged nerves. However, in spite of the scientific advancements, applications to the patients is still limited and it appears that to optimize the strategy for the tissue engineering of the peripheral nerves in the clinical view, more basic science research is needed and neuroscientists have to strive for a new level of innovation which will bring together (in a multi-translational approach) the main pillars of tissue engineering, namely 1) Microsurgery, 2) Transplantation (of tissues, cells and genes), 3) Material science, 4) Physical therapy. Regarding the latter approach, one of the most promising strategies that has been successfully used is Low Level Laser Therapy (LLLT). Increasing evidence has accumulated over the last 20 years about the potential effect of LLLT both for promoting posttraumatic axonal regeneration and for preventing denervation-related skeletal muscle atrophy and both these effects can be very useful for improving the functional outcome after peripheral nerve injury. In this presentation, I will provide an brief overview of last advancements in peripheral nerve tissue engineering in order to throw a light on the most promising future perspectives in combining the different strategies for improving posttraumatic recovery. In particular, I will focus on LLLT and on how its efficacy could be improved if included in the context of a multilevel tissue engineering approach.

27B1130 Rochkind

Abstract presentation

Title: Phototherapy for Preservation of Denervated Muscle in Complete Peripheral Nerve Injury

Author(s): Shimon Rochkind^{1,2}, Asher Shainberg²

¹Division of Peripheral Nerve Reconstruction, Department of Neurosurgery,

Tel Aviv Sourasky Medical Center, Tel Aviv University, Israel; ²Faculty of Life Science, Bar-Ilan University, Israel

Background: In complete peripheral nerve injuries denervated muscles progressively deteriorate. Numerous attempts were made to decrease or prevent muscle atrophy. Among the proposed methods, phototherapy has received increasing attention over the last two decades.

Methods: In rat model complete denervation of the gastrocnemius muscle, by removal of 1cm segment of the sciatic nerve, was performed. Rats were divided into 3 groups (15 rats each): denervated non-irradiated; denervated laser treated; intact. The rats underwent laser treatment (HeNe laser, 35mW, 30 minutes) every day, for 14 days.

CK activity was measured by the specific spectrophotometrical method 7, 30, 60 and 120 days after denervation in both denervated and intact muscles.

Internal and membrane inserted acetylcholine receptors (AChR) was quantitated by ¹²⁵I-alpha-bungarotoxin 7, 30, 60 and 120 days after denervation in both denervated and intact muscles. Radioactivity was assessed with Auto-Gamma Counter.

Results: After denervation, in control group CK activity sharply decreased to 41% of the normal value in comparison to the delayed and attenuated decrease in the laser-treated group which preserved 83% of normal value. After 30 days, CK activity gradually decreased in both groups, however in laser treated group it was better preserved until 4 months after denervation.

After complete denervation, in control group AChR partially increased in comparison to intact group, and remained almost at same level for 30 days. However, in laser treated group, 7 days after

denervation AChR remained at nearly normal value (which suggests protective effect of laser treatment), and stayed significantly higher 30 days than in control denervated group. After 30 days the amount of AChR progressively decreased in both groups due to muscle degenerative process, but in laser treated group it preserved better than in non laser treated group.

Conclusion: These findings could have direct therapeutic applications on preserving the function of denervated muscle after peripheral nerve injury.

27B1145 Chavantes

Abstract presentation

Title: LOW LEVEL LASER THERAPY IN PAINFUL NEUROMA REFRACTORY TO CONVENTIONAL TREATMENT IN AMPUTATION STUMPS: PILOT STUDY.

Author(s): Nancy S.Yonekawa¹, Fernando C. G. Pinto², Elizabeth M.Yoshimura³, M.Cristina Chavantes¹. ¹ Laser Medical Center Incor, Clinical Hospital, Medical School - University of São Paulo; ² Neurosurgery Division of Clinical Hospital, Medical School, University of São Paulo; ³ Dosimetry Department, Physic Institute of University of São Paulo São Paulo, SP, Brazil.

Background and Objective: Painful neuroma in the amputated stump can be psychologically and physically disabling. In fact, peripheral nerve trauma may result in neuroma formation that consisting of a tangled mass of regenerating collateral axons sprouts, growing into surrounding tissue and scar formation. Our aim is to evaluate the Low Level Laser Therapy (LLLT), in cases that all kind of treatment failed, especially in the presence of chronic debilitating stump pain.

Methods: This pilot study had 3 male patients, average of 40y.o., with post traumatic pain involved in a work-related accident. All of them had a cold intolerance and complained about intermittent chronic pain stump with similar baselines (high intensity and debilitating stump pain), which were previously treated with strong painkiller drugs and considered clinically refractory. A sharp and shocking pain was elicitable with light tapping. Hypersensitivity was found in the finger stump. They were submitted to Infrared (780nm) Diode Laser on the stump, power= 40mW, fluence= 25-40 J/point. LLLT sessions were once a week.

Results: They reported a decrease in the intensity of the pain and increased their ability in daily living activities during a 12-month follow-up, making the results a benefit trend for laser therapy in patients with debilitating stump pain. Our results showed a marked improvement in all patients and in 1 patient some finger function was regained.

Conclusion: All patients in our study had a markedly pain relief and quality of life's improvement, thus LLLT proved to be non-invasive, safe and effective tool to treat neuroma.

27B1200 Pereira

Abstract presentation

Title: LOW LEVEL LASER THERAPY IN POSTHERPETIC NEURALGIA REFRACTORY TO CONVENTIONAL TREATMENT: AN EFFECTIVE RESPONSE

Author(s): Pereira, M.H.C.²; Pinto, N.C.¹; Raya, A¹; Okada, M.³; Yoshimura, E.M.⁴; Chavantes, M.C.¹. 1- Laser Medical Center of Heart Institute (InCor), Clinical Hospital, Medical School, Universidade de São Paulo. 2 -Pain Service, Anesthesiology Department of Heart Institute (InCor) – Clinical Hospital, Medical School, Universidade de São Paulo. 3 -Neurosurgery Division of Clinical Hospital, Medical School, Universidade de São Paulo. 4 - Physics Institute, Universidade de São Paulo.

Background and objective: Neuropathic pain is a disease in itself and the postherpetic neuralgia (PHN) can be tough to manage and resistant to many types of pharmacologic and interventional therapies. Many analgesic agents used to treat may cause systemic side effects, with low efficacy for treating pain from PHN. The application of Low Level Laser Therapy (LLLT) can decrease the pain and the need of drugs consuming, these benefits has been established, either in several experimental or in clinical papers. Such adjuvant therapy employing the LLLT may reduce the need of drug administration.

Methods: Pilot study with 10 patients, aged 62-78 years (mean 72; 8 F, 2 M) complained of pain lancinating, burning, shooting, itching, with allodynia, long lasting, without answer to usual therapy, with high average in Visual Analogical Scale (VAS), thus compromising the daily activities and quality of life. Each patient were evaluated pre and post infrared Diode Laser, P=40mW, T.E=64 (SD-25)J, T=40s, punctually into the pain area and all around the dermatome section, once a week.

Results: In all cases we have pain reduction –VAS pre LLLT: mean 7,3 (SD-1,25); VAS post LLLT 1,8 (SD-1,8). Total sessions varied from 3 to 12.

Conclusion: Lasertherapy is a non invasive method that provided an expressive remission of the pain symptoms. LLLT can be useful in older patients where PHN remains a common complication of Herpes Zoster. Our study signalize that LLLT can reduce pain level, without side effects and improving patients' quality of life.

27B1215 Pizzo

Abstract presentation

Title: **ANTIALGIC EFFECT OF LOW INTENSITY LASER IN THE TREATMENT OF CERVICOGENIC HEADACHES**

Author(s): Pizzo, R. C. A.; Dach, F.; Bordini, C. A.; Lizarelli, R. F. Z*; Speciali, J. G.

Department of Neurociences, Division of Neurology, School of Medicine, Clinical Hospital of Ribeirão Preto – University of São Paulo; Physics Institut of São Carlos, Optics Group, Biophotonics Laboratory – University of São Paulo, São Carlos, SP – Brazil.

Background and Objective:Cervicogenic headache(CH) is any type of headache originating in low neck structures. It is characterized by nuchal and/or frontotemporal pain triggered by disturbances in the neck region at the C1, C2 or C3 level. Blockade of the major and minor occipital nerves is performed for therapeutic and diagnostic purposes. To determine the effect of low intensity laser (GaAlAs) applied to the region of the major and minor occipital nerves and/or of the C₂ root on the symptomatic side for the treatment of cervicogenic headaches, as an alternative procedure to conventional blockade.

Material and Method:Twenty patients from the Headache Outpatient Clinic of the University Hospital of FMRP/USP were submitted to the procedure. Each patient was evaluated by a neurologist, who made the diagnosis of CH (SJAASTAD,1990). The patients were submitted to laser applications (780nm,70mW,continuous) on the symptomatic side at 8 trigger-points located by palpation in the region of the major and minor occipital nerves, with one D=157,5J/cm² per point being applied once a week for 4 weeks. The patients filled out a pain diary (scores of 0 to 10) and were evaluated on four occasions: A0(before the 1st application),A1(immediately after the last application),A2 and A3(30 and 60 days after the last application).

Results:The weekly mean pain score was calculated (A0=9.635;A1=2.638;A2=2.788;A3=2.937) and analysis of the results identified statistically significant differences (p=0.001, paired t-test) between A0 and A3 regarding pain intensity.

Conclusion: On the basis of the above data, we may suggest that low intensity laser promoted a reduction of the intensity and frequency of symptoms.

(Green)

Musculoskeletal

27G0845 Konstanstinovic

Invited speaker

Low-Level Laser Therapy for Acute Low Back and Neck Pain with Radiculopathy

Ljubica M. Konstantinovic

Clinic for rehabilitation, Medical School, University of Belgrade, Serbia

Background and objective: Inflammation is the main pathological factors of radiculopathy in association with disc herniation. Modulation potential of LLLT was demonstrated on inflammatory phase of healing process. The aim of this study was to investigate clinical effects of low-level laser therapy (LLLT) in patients with acute low back pain (LBP) and acute neck pain (NP) with radiculopathy.

Methods: A randomized, double-blind placebo-controlled study in 546 with acute LBP and in 60 subjects with acute NP was done. Subjects were randomized to receive a course of 15 treatments with either LLLT as active or placebo procedure as additional therapy to anti-inflammatory drugs. LLLT was applied to skin projection of anatomical site of involved spine segment with following parameters: wavelength 904 nm, frequency 5000Hz, and 100mW average diode power, power density of 20mW/cm², and dose of 3J/cm² (LBP), and 2J/cm² (NP) per point, at whole daily doses of 12J. The outcome measures were pain intensity measured by Visual Analogue Scale and local movement, disability index and quality of life. Measurements were taken at baseline and at the end of treatment. Statistical analyses were done with SPSS 11.5.

Results: Statistically significant differences were found in all outcomes measured ($p < 0.001$), but better in group treated with active LLLT, with high effects size for pain intensity in arm ($d = 0,92$) and in leg ($d = 0,85$).

Conclusion: Treatment of acute LBP and NP with radiculopathy at 904 nm LLLT has shown better results in all investigated parameters in comparison with patients treated with drugs and with placebo procedure.

27G0915 Jovicic

Abstract presentation

Title: Comparison of two different energy doses of low level laser therapy for acute lumbar radiculopathy due to disc herniation

Author: Jovicic M¹. ¹ Institute for Rehabilitation, Medical School, University of Belgrade, Serbia

Background and objective: The purpose of this study was to investigate the effects of two different energy densities of low level laser therapy (LLLT) on acute lumbar radiculopathy due to disc herniation (ALR). Methods: Forty-four patients with ALR were randomly divided into two equal groups. Both groups received LLLT on the involved spine segment using a stationary skin-contact method. Patients were treated 5 times weekly, for a total of 10 treatments, with the following parameters: wavelength 904 nm; frequency 3000Hz; average diode power 40 mW; energy dose of 1 J/cm² in the first group and 4 J/cm² in the second group; treatment time 50 s per point with accumulated daily energy of 4 J in the first and 200 s and 16 J in the second group. The clinical assessments of lumbar and leg pain, functional and quality of life (QOL) changes were done before and after two weeks treatment using visual analogue scale (VAS), Schober test, manual muscle testing, straight leg raise test and NA Spine Society Low Back Pain outcome instrument. Results: Before treatment, there were no significant differences between groups for all assessments ($p > 0.05$). Highly significant improvements ($p < 0,01$) were noted in both groups after LLLT with respect to all investigated parameters. The VAS scores were significantly lower in both groups without difference between groups ($p > 0,05$). The QOL improvements and lumbar mobility were better in the second

group treated with the dose of 4 J/cm² than in the first group (p<0,05). Conclusion: Two different energy doses of LLLT were equally effective in alleviating lumbar and leg pain without side effects, but the dose of 4 J/cm² seemed to be more effective in improving QOL and lumbar mobility.

27G0930 Helga Ferreira

Abstract presentation

Title: LOW INTENSITY LASER THERAPY ON SIDE EFFECTS OF CHEMOTHERAPY AND/OR RADIOTHERAPY IN HEAD AND NECK CANCER

Author(s): Helga Ferreira¹, Thays Pithon Quadros Ravazzi¹, Leila Soares-Ferreira², Leonardo dos Santos Osório³, Mariana da Silva Maia⁴, Fernando Almeida⁵, Daiane Thais Meneguzzo^{1,6}

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Background and objective: Radiotherapy and chemotherapy are anticancer treatments that cause many side effects in oral mucosa, such as oral mucositis (OM), edema, xerostomia, trismus, ototoxicity, neurotoxicity, dermatitis and dentine hypersensitivity. Low intensity laser therapy (LILT) has proved to be effective in prevention, to reduce pain and healing of OM. The objective is to show the effectiveness of LILT not only in OM but also in all oral symptoms of patients under anticancer treatment.

Methods: We have treated 8 patients between 50 and 92 years old with a diagnosis of head and neck cancer. The LILT was done 5 days per week, irradiating different facial areas: mouth, throat, salivary gland, TMJ, facial surface, and teeth with. The irradiation was performed punctually (1 point per cm²) with continuous diode laser (660 and 808nm, spot area of 0,028cm²) using the following parameters: 100mW, 1 to 4 Joules per point, exposure time of 10 to 40 seconds per point.

Results: Pain relief was reported immediately and all the side effects were significantly reduced by LILT. An improved quality of life of these patients has been achieved since the extent of side effects did not become a limiting factor in cancer treatment.

Conclusion: The laser proved to be a great ally in antitumor treatment by improving the quality of life of patients, as well as enabling the continuation of chemotherapy and radiotherapy, often limited due to the side effects produced.

27G0945 Ailioaie

Abstract presentation

Title: LOW LEVEL LASER THERAPY IN CHRONIC PAIN IN JUVENILE-ONSET SPONDYLOARTHRITIS

Author: C. Ailioaie^{1,3}, L.M. Ailioaie^{2,3}. ¹“Gr. T. Popa” University of Medicine and Pharmacy, Iasi, Romania. ²“Al. I. Cuza” University, Iasi, Romania. ³Laser Clinic, Iasi, Romania.

Background and objective: In the last decade is becoming widely accepted that the treatment regimen for children with Juvenile-onset Spondyloarthritis (JSpA) should be individualized according to how severe the disease is and whether there are complications, using also multidisciplinary methods. The aim of this study was to assess the effects of low level laser therapy (LLLT) on patients with chronic pain in JSpA.

Methods: For a period of 9 months, were included in the study a number of 34 patients with mean age of 12.2 years, diagnosed with JSpA (ESSG criteria and ILAR - Enthesitis-related arthritis) who received local LLLT (Group I), comparatively with a control group of 33 patients (Group II) who received placebo laser.

The treatment protocol consisted in laser irradiation with 3 J/cm² of the affected entheses located at the heel, in the mid-foot and around the kneecap, and/or iliac crests, anterosuperior and posterosuperior iliac spines, and with 2 J/cm² of the loco-regional lymph nodes (under mandible,

latero-cervical, groin etc.) using a GaAlAs probe of 830 nm, 300 mW, 10 Hz. LLLT was administered every second day, 10-12 sessions, repeated after 3 months.

Results: At the end of the study, the level of chronic pain estimated with Commander Algometer (JTECH Medical) decreased by 46.5% in Group I compared with 27.2% in the control Group, and the range of motion in the affected joints assessed with JTech Dual Inclinator System increased by 60% in the LLLT Group compared with 29% in the placebo Group.

Conclusion: LLLT proved to be an effective alternative method of complex therapy of chronic pain in children and adolescents with Juvenile-onset Spondyloarthritis.

27G1000 Salansky

Abstract presentation

Title: A Novel Concept of Chronic Pain Mechanisms and Effective Pain Treatment with Multimodality Low Energy Photonic and Laser Therapy (LEPT)

Author(s): Natasha Salansky (1), Abraham Chaiton (2), Heather Tick (3), Norman Salansky (1), Galyna Gorokhova (1), Yuri Sapilo (1). 1 Millennium Health Institute, 1600 Steeles Ave W, Unit 21, Concord, ON, L4K 4M2, Canada; 2 University of Toronto, Toronto, Canada; 3 University of Arizona, Tucson, USA; Canadian Memorial Chiropractic College, Toronto, Canada

Background and objective: We hypothesized that many types of chronic pain may be caused by the following three basic underlying tissue pathological conditions: depletion of cellular energy ATP (ischemia); chronic inflammation with imbalance of tissue prostaglandins and cellular hormones; and impaired or insufficient microcirculation. Analysis of scientific data suggests that above pathological conditions could be improved or reversed to normal using treatment with specific forms of monochromatic light (low energy photons). We call them "Therapeutic Optical Windows" (TOWs). In addition, there is also a possibility to induce pain relief through release of endogenous opioid peptides (endorphins) and biogenic amines mediated by specific lasers and photonic sources. Multimodality clinical protocols were developed for different musculoskeletal and neuromuscular conditions (back pain, shoulder pain/frozen shoulder, carpal tunnel syndrome and others).

Methods: These protocols include application of required TOWs in sequence one after another to improve different tissue pathologies that contribute to pain and to help release of own body pain killers. These clinical protocols were tested in five clinical trials on the efficacy of Multimodality Low Energy Photonic and Laser Therapy (LEPT) for pain in joints and back, chronic whiplash, frozen shoulder, and carpal tunnel syndrome.

Results: Results of these clinical trials revealed statistically and clinically significant short- and mid-term pain relief using the above LEPT protocols. In addition, there were also observed objective improvements in disability indexes, ranges of motion, median nerve distal motor latency, quality of night sleep, and reduction of pain medication.

Conclusion: These positive clinical data warrant large-scale trials for further clinical assessment and optimization of these multimodality LEPT protocols.

27G1015 Olah

Abstract presentation

Title: The effects of infrared laser therapy and weightbath traction hydrotherapy in cervical discopathy

Author(s): Csaba Oláh MD', László Fügedi MD', Tamás Bender MD", PhD, Mihály Oláh MD* Borsod County University Teaching Hospital, Miskolc, Hungary'; Polyclinic of the Hospitaller Brothers of St. John of God in Budapest, Hungary"; Hungarospa Health Resort, Hajdúszoboszló, Hungary*

Background and objective: Background: The therapeutic modalities available for the conservative management of chronic cervical pain included infrared laser therapy and underwater traction, which usefulness is not universally acknowledged. This study was intended to ascertain any beneficial impact of infrared laser therapy and weightbath treatment on the clinical parameters and quality of life of patients with cervical discopathy.

Methods: Material and methods: The study population comprised 54 randomised subjects. I. group of 18 patients received only infrared laser therapy to cervical region and painful points. II. group of 18 subjects each received underwater traction therapy of cervical spine with add-on McKenzie exercise and iontophoresis. The remaining III. group treated with exercise and iontophoresis, served as control. VAS, SF 36 scores, range of motion, neurological findings were monitored to appraise therapeutic efficacy in cervical discopathy. MRI scan was done at baseline and after 3 months follow-up. We have done financial measurements.

Results: Results: Infrared laser therapy and underwater traction for discopathy achieved significant improvement of all study parameters, which was evident 3 months later. Among the controls, significant improvement of only a single parameter was seen in patients with cervical discopathy.

Conclusion: Conclusion: Infrared laser therapy and underwater traction treatment effectively mitigate pain, muscle spasms, enhance joint flexibility, and improve the quality of life of patients with cervical discopathy.

27G1445 Saraga

Abstract presentation

Title: LASER THERAPY FOR THE TREATMENT OF ARTHRITIC KNEES: A CLINICAL STUDY

Author(s): F. Saraga^a, R. Liboro^a and F. Kahn^a. ^aMeditech Laser Rehabilitation Centre, 415 Horner Ave, Toronto, ON, Canada, M8W 4W3.

Background and objective: Arthritis results in the deterioration of the joints through the process of chronic inflammation. The most common form is osteoarthritis, a degenerative joint disease which is estimated to affect 80% of the population by age 65. Osteoarthritis commonly affects the hands, feet, spine, and the large weight bearing joints such as the hips and knees. According to the Center for Disease Control, the lifetime risk of developing osteoarthritis of the knee has been estimated at 46%. Recent studies have shown patients with this condition are unlikely to benefit from arthroscopic surgery. On the other hand, clinical trials have shown that Low Intensity Laser Therapy for knee osteoarthritis significantly improves pain, function and quality of life of patients.

Methods: In a follow-up clinical study to our previously published 2006 SPIE conference proceeding, we analyzed a cross-section of patients treated for a variety of knee problems that present at our Meditech Laser Rehabilitation Clinics on a daily basis including type of pathology, age distribution, number of treatments and percent of overall improvement.

Results: Of the 98 patients with knee pathologies included in this study, 63% presented with degenerative osteoarthritis. On average 11 treatments, each 30-45 minutes in duration, were administered for the individual patient resulting in a significant improvement rate in excess of 92%.

Conclusion: Laser Therapy is active at both the cellular and systemic levels activating a variety of mechanisms including cartilage regeneration, DNA synthesis, improved microcirculation and an analgesic and anti-inflammatory effect.

27G1500 Mokmeli

Abstract presentation

Title: Comparing the effect of low level laser therapy (LLLT) with Celecoxib in knee osteoarthritis (OA)

Authors: S. Mokmeli¹, MD anaesthesiologist, Kh. Abbasi Chemical Eng ², S.M. Hosseini³, MD, F. Porazadi³ MD, Orthopaedic, SH. Bisheh³ BSc. 1 - Laser Department Milad Hospital, Iranian Medical Laser Association (IMLA), Tehran, Iran. 2-Biophotochemical Organization (PTE), Tehran, Iran. 3-Laser Department Milad Hospital, Tehran, Iran.

Background: Celecoxib is a cyclo-oxygenase inhibitor that is an accepted alternative medicine for NSAIDs in knee osteoarthritis (OA), particularly in patients at high risk of developing gastrointestinal events. Celecoxib produces significant improvements in pain and inflammation with lower side effects than NSAIDs. LLLT has been used for pain attenuation in different conditions. This study compares the effects of LLLT with celecoxib in knee OA.

Material and method: 64 patients with knee OA were allocated randomly in 2 groups (n=32). Group A consumed celecoxib 200 mg per day for 4 weeks and group B were treated by LLLT (3 sessions per week) for 4 weeks (1- λ =860 nm, peak power=100 W, F=3000 Hz, Δt =180nsc, Area=1cm², Dose=6J/cm², points= at least 8 points, 2- λ = 650 nm, p=100mW, A=0.2cm², Dose =10J/cm² 2J/point, 2 points). Groups were evaluated by pain and stiffness subscale of WOMAC index, pain number (VAS), knee oedema and the range of motion to cause pain before and after the treatment (1 month later).

Results: The results were analyzed with SPSS program (Fisher exact T test, Pair sample test). There was a significant difference between subjective and objective parameters before and after both celecoxib consumption and LLLT statistically (p value<0.001), however LLLT was more effective than celecoxib for attenuation of night pain, weight bearing pain, pain number and reduction of knee oedema (p value<0.001). No side effects were reported for LLLT.

Conclusion: Our study showed that LLLT is more effective than celecoxib in pain and oedema reduction in knee OA.

27G1515 Ailioaie

Abstract presentation

Title: THE EFFECTS OF INTRAVENOUS LASER BLOOD IRRADIATION AND INDIVIDUALIZED PHYSICAL THERAPY IN JUVENILE ARTHRITIS

Author(s): L.M. Ailioaie^{1,3}, C. Ailioaie^{2,3}. ¹“Al. I. Cuza” University, Iasi, Romania. ²“Gr. T. Popa” University of Medicine and Pharmacy, Iasi, Romania. ³Laser Clinic, Iasi, Romania.

Background and objective: The aim of this study was to evaluate the effects of Intravenous Laser Blood Irradiation (ILBI) in children with chronic arthritis.

Methods: 47 children (Group 1) with a mean age of 11.9 years, diagnosed with Juvenile Idiopathic Arthritis (JIA) received ILBI daily, 7 to 10 sessions per month, repeated every 3 months for 12 months. ILBI was applied using a GaAlAs probe (3 mW, cw, 630 nm), 15 minutes each session, together with individualized physical therapy, comparatively with 45 JIA patients (Group 2 - control), who received only conventional therapy for a period of 12 months.

The outcome in both groups was measured using the following criteria: number of joints with pain and / or tenderness at motion, tender joints count, swollen joints count, patient's and family's global assessment (0 = best health status, 10 = worst possible health status), physician's global assessment (0 = absence of the disease, 10 = most severe disease), Childhood Health Assessment Questionnaire, Erythrocytes Sedimentation Rate and level of C-Reactive Protein.

Results: At the end of treatment protocol, ILBI proved to be an efficient alternative therapy for pain control, reduction of tender and swollen joints, movement range improvement, comparatively with the control group (p < 0.05).

Conclusion: ILBI together with individualized physical therapy has decreased pain, increased strength and mobility in the arthritic joints, thereby preventing risks of pharmacological therapy and disability, statistically significant compared with the control group.

27G1530 Pinfildi

Abstract presentation

Title: Physical therapy protocol with sensory motor training and associated with cluster diode laser in patients with knee osteoarthritis

Authors: Carlos E Pinfildi; Cintia M Silva; Marina CS Tramonte; Tatiana R Sheliga; Rodrigo P Prado.

Background and objective: The physical therapy rehabilitation and sensory motor training and low level laser therapy offers promising symptomatic relief of osteoarthritic pain and improve functional performance. The aim of this study was to assess the effect of the treatment protocol and low level laser therapy associated in patients with knee osteoarthritis (OA)

Methods: Fourteen patients with knee OA unilateral or bilateral clinical and X-ray diagnosed participated of this study. The patients were divided in two groups (control with protocol only and treatment with protocol with LLLT) and were undergone to exercises treatment protocol per 8 weeks

during 2x per week. The protocol was constituted by passive stretching of the hamstring, quadriceps femoral and calf muscles with 3X30 seconds; SLR of the hamstring, quadriceps femoral, calf muscles and abductors and adductores muscles with 3X12 repetitions. The proprioception training was realized by bipodal and unipodal balance training with balance board; sensory motor training with balance and gait. The LLLT group used cluster with nine diodes (four 670nm and five 850nm with output power 500mW). The fluence used was 4J/cm². The groups were evaluated pre and post treatment with SF-36, Lequesne questionnaire, Tinetti scale and VAS.

Results: The results was analyzed by Wilcoxon Test between pre and post assessments intra groups and inter groups and showed significant differences in the LLLT group and Control group with all assessments, but when was compared LLLT group with Control group were not found differences.

Conclusion: The study showed that physical therapy protocol only may be improving the OA patients functional performance and quality of life. But the physical therapy protocol associated with LLLT may be improving the pain and functional performance of them.

(Purple)

Dentistry / Wound healing

27P0915 Katayoun Kalhori

Abstract presentation

Title: **New Modality of PDT “Trojan Horse” in Oral &Maxillofacial Tumors**

Authors: Reza Fekrazad, Katayoun AM Kalhori*. Institute: Shaheed beheshti University of Medical Sciences, Dental Department. Flat No.12 ,Mooj Building, First Behestan, Pasdaran Street ,Tehran ,IRAN.

Abstract: In conventional photodynamic therapy a triangle relationship does exist in which one angle is photosensitizer, another one is photon, which can be released from any source and the last angle is oxygen. Literature shows that sufficient amount of oxygen has a major role in singlet oxygen production. This event along side with photochemical interaction between laser photon and PS leads to gradual death of the cell homing process. Each of these three elements has a significant role. Some new studies have been done to improve them.

Recently, applying Nanoparticles and immunological mechanisms has explained a new approach for treating diseased cells, either cancerous cells or microorganisms .The dominant interaction is of photothermal kind and oxygen has not a major role here.

In this new method, despite the common photodynamic therapy method, increasing a few degrees of temperature would lead decrease in enzyme function and protein denaturation and finally death of cell or micro-organisms. This is especially important when you are dealing with cancerous tumors in depth where there is lack of oxygen, also in infectious lesions like periodontal packets, where anaerobic pathogen micro-organisms are in major.

One of the best known ways is adhering nanoparticles to especial antibodies and transferring to immunological cells and penetrating in these regions along side with interaction of photons from a light source especially laser can lead to the death of these cells or micro organisms. This can be compared with Trojan Horse story. This method might be used in future for eliminating virus and pathogen unites which have no normal cell structure.

27P0930 Lizarelli

Abstract presentation

Title: **STUDY FOR DEVELOPMENT OF CLINICAL PROTOCOLS USING LEDTHERAPY**

Author(s): R. F. Z. Lizarelli1; R. Z. Lizarelli1; S. C. Nunez3; R. Tucci1; R. C. A. Pizzo1; V. H. Panhoca2; M. M. Costa2; V. S. Bagnato2. 1 - NILO (Núcleo Integrado de Laser em Odontologia), Ribeirão Preto, SP; 2 - Instituto de Física de Sao Carlos - USP, São Carlos, SP; 3 – IPEN, Universidade de Sao Paulo, Sao Paulo, SP - Brasil.

Background and objective: Laser and LED therapies constitute important advances in contemporary Dentistry. These technologies are easily accessible to professionals, and Brazil has been one of the worldwide pioneers in several innovations concerning this subject. The employment of lasers, operating in low intensity as therapeutical instruments, has been presenting successful results for more than two decades in Brazil. Thereby, since 1996 some researchers have searched for equivalence and greater effectiveness of devices based on LEDs (light emitting diodes) in the therapies of pain relief, tissue repair stimulation and lymphatic drainage. Some studies have demonstrated that lasers and LEDs, under the same parameters of irradiation, lead to the same clinical results when the LEDs are used for analgesic purposes; and, it is not about a new procedure.

Methods: A pioneering project, supported by CNPq, carrying out laboratorial experiments and clinical studies is currently in progress. Clinical diseases and situations commonly found in dental treatments will be approached, such as TMJD (temporo-mandibular joint disorder), dentin hypersensitivity, and, soft tissue injuries (surgical wounds, labial herpes, mucositis and ulcers) with or without infection.

Results: The goal is to suggest spectral bands, doses, frequency of applications, as well as the handling of possible adverse responses throughout the treatment, thereby contributing to Biotechnology innovation in dental treatments.

Conclusion: This is an innovative project will allow a profit increased on both NILO and Laser/Led's company and gives another alternative for patients using a set of dental clinical protocols and equipment for photo-therapy based on light emitting diodes (LEDs) operating in low intensity.

27P0945 Hans Romberg

Abstract presentation

Title: Is there really a threshold observed in the dose-effect relationship for laser and LED phototherapy?

Author(s): Hans A. Romberg. Dr. Hans Romberg Medizintechnik, Schillerstr. 44, D 76297 Stutensee, Germany, and International Institute for Interdisciplinary Medicine, I³M, Unter der Schanz 2, D 69117 Heidelberg, Germany.

Background and objective: Often a threshold is claimed to have been observed. This is commented from a physicist's point of view.

Methods: Some published data on dose-effect relationship is looked at, as well in vitro as in vivo, and is modeled by very simple mathematical methods.

Results: The observed threshold by looking with naked eye on data plotted using logarithmical energy scale is shown to be an artifact of this data plotting. Error bars usually are too big to give significant results on the existence of a threshold.

Conclusion: Logarithmic scales may be useful, and even appropriate for parameter in nature, but the interpretation and meaning of „threshold“ has to be looked at a bit closer.

27P1100 Parizotto

Invited speaker

BIOSILICATE® AND LOW LEVEL LASER THERAPY IMPROVE BONE REPAIR IN OSTEOPOROTIC RATS

Paulo Sérgio Bossini¹, Ana Claudia Muniz Renno², Daniel Araki Ribeiro², Renan Fangel¹, Oscar Peitl³, Edgar Dutra Zanotto³, **Nivaldo Antonio Parizotto¹**

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The aim of this study was to investigate the effects of a novel bioactive material (Biosilicate®) and low level laser therapy (LLLT) on bone fracture consolidation in osteoporotic rats. Forty female Wistar rats were submitted to the ovariectomy (OVX), to induce osteopenia. Eight weeks after surgery, animals were randomly divided into four groups, with 10 animals each: bone defect control group (CG); bone defect filled with Biosilicate® group (BG); bone defect filled with Biosilicate® and irradiated with LLLT, at 60 J/cm² group (BG60); bone defect filled with Biosilicate® and irradiated with LLLT, at 120 J/cm² group (BG120). Bone defects were surgically performed on both tibias. The size of particle used for Biosilicate® was 180-212 micrometers. LLLT, either with 60 J/cm² or 120J/cm² was able to increase collagen, Cbfa-1, VEGF and COX-2 expression in the circumjacent cells of the biomaterial. A morphometric analysis revealed that the Biosilicate® plus laser groups showed a higher amount of newly formed bone (p<0,05). Our results indicate that laser therapy improves bone repair process in contact with Biosilicate® as a result of increasing bone formation as well as COX-2 and Cbfa-1 immunoexpression, angiogenesis and collagen deposition in osteoporotic rats.

Key words: Biosilicate®, bone repair, low level laser therapy, osteoporotic rats.

27P1130 Renno

Abstract presentation

Title: Comparative study of the effects of low- intensity pulsed ultra-sound and low level laser therapy on bone defects in tibias of rats

Author(s): Ana Claudia Muniz Renno², Elaine Fávoro-Pípi¹, Suellen Maurin Feitosa², Daniel Araki Ribeiro², Paulo Bossini¹, Poliani Oliveira¹, Nivaldo A Parizotto¹. ¹ Department of Physiotherapy, Federal University of São Carlos. Rodovia Washington Luís (SP-310), Km 235, São Carlos, SP – Brazil.

²Department of Bioscience, Federal University of São Paulo. Av. Ana Costa, 95, Santos, SP – Brazil.

Abstract: The aim of this study was to investigate and to compare the effects of low intensity ultra-sound (LIPUS) and low level laser therapy (LLLT) during the process of bone healing by means of histopathological and morphometric analysis. The animals were randomly distributed into three groups of 30 animals each: control group (bone defect without treatment); laser treated: (bone defect treated with laser) and LIPUS treated (bone defect treated with ultra-sound). Each group were divided into 3 different subgroups (n=10) and on days 7, 13 and 25 post-injury, rats were sacrificed with an intra-peritoneal injection of general anesthetic. The rats were treated with a 30 mW/cm² low intensity pulsed ultra-sound and a 830nm laser, at 50J/cm². The results pointed out intense new bone formation surrounded by highly vascularized connective tissue presenting a slight osteogenic activity, with primary bone deposition was observed in the group exposed to laser in the intermediary (13 days) and late stages of repair (25 days). This was confirmed by morphometric analysis, in wich significant statistically differences (p<0.05) were noticed when compared to control. No remarkable differences were noticed to the specimens treated with ultra-sound with regard to the amount of newly formed bone in comparison with the control group. Taken together, our results

indicate that laser therapy improves bone repair in rats as depicted by histopathological and morphometric analysis, mainly at the late stages of recovery. Moreover, it seems that this therapy was more effective than US to accelerate bone healing.

Key words: bone repair; rats; low level laser therapy; low- intensity pulsed ultra-sound

27P1145 Renno

Abstract presentation

Title: LOW LEVEL LASER THERAPY DOES NOT MODULATE THE OUTCOMES OF A HIGHLY BIOACTIVE GLASS-CERAMIC (BIOSILICATE®) ON BONE CONSOLIDATION IN RATS

Author(s): Ana Claudia Muniz Renno², Poliani Oliveira¹, Daniel Araki Ribeiro², Elaine Favaro Pipi¹, Patricia Driusso¹, Nivaldo A Parizotto¹. ¹ Department of Physiotherapy, Federal University of São Carlos. Rodovia Washington Luís (SP-310), Km 235, São Carlos, SP – Brazil. ² Department of Bioscience, Federal University of São Paulo. Av. Ana Costa, 95, Santos, SP- Brazil.

Abstract: The main purpose of the present work was to evaluate if low laser level therapy (LLLT) can improve the effects of novel fully-crystallized glass-ceramic (Biosilicate®) on bone consolidation in tibial defects of rats. Forty male Wistar rats with tibial bone defects were used. Animals were divided into four groups: group bone defect control (CG); group bone defect filled with Biosilicate® (BG); group bone defect filled with Biosilicate®, irradiated with LLLT, at 60 J/cm² (BG60) and group bone defect filled with Biosilicate®, irradiated with LLLT, at 120 J/cm² (BG120). A low-energy GaAlAs 830nm, CW, 0.6 mm beam diameter, 100 W.cm⁻², 60 and 120 J.cm⁻² was used in this study. Laser irradiation was initiated immediately after the surgery procedure and it was performed every 48 h for 14 days. Fourteen days post-surgery, the three-point bending test revealed that the structural stiffness of the groups CG and BG was higher than the values of the groups BG60 and BG120. Morphometric analysis revealed no differences between the control group and the Biosilicate® group. Interestingly, the groups treated with Biosilicate® and laser (BB60 and BB120) showed statistically significant lower values of newly formed bone in the area of the defect when compared to negative control (CG) and bone defect group filled with Biosilicate (CB). Our findings suggest that although Biosilicate® exerts some osteogenic activity during bone repair, laser therapy is not able to modulate this process.

Key words: low level laser therapy; Biosilicate®; bone repair; rats

27P1200 Dana York

Abstract presentation

Title: Title of abstract Bone Growth and LLLT

Author(s): Dana Vieru York. Faculty of NYU Dental School, Cariology Department, NY, NY, USA.

Background and objective: What was the major reason for doing this study? The general objective of this study is to demonstrate that the application of low-level-laser therapy (LLLT) in addition to standard procedures employed to treat periodontal disease improves the outcome of the treatment.

Methods: We plan to recruit approximately 200 patients with marginal advance chronic periodontitis. 100 of them are diabetic and another 100 show symptoms of osteoporosis. A correct diagnostic will be assessed based upon the medical and dental history. All these patients will be treated in a classical modern treatment. Approximately half of the diabetic patients and half of the patients with osteoporosis will receive LLLT in addition to the classical treatment. (The number of patients to be enrolled was determined by power calculations using the data obtained in our pilot studies.)

Results: These studies showed that subjects receiving LLLT in addition to traditional treatment enjoyed markedly better recovery and healing than subjects treated without LLLT. LLLT results in shorter pain recovery time, bleeding and reduced post surgery complications (edema, inflammation, and infection), in addition faster formation and maintenance of the mastication functions were observed.

Conclusion: General social benefits are the development of novel and inexpensive LLLT modality for treatment of periodontal disease, which allows for early noninvasive treatment of periodontal infection. LLLT technology promises to be more cost effective and may reduce the cost of patient care, while improving the good results already achieved by meticulous classic periodontal intervention.

27P1415 Enwemeka

Invited speaker

Efficacy of Laser Phototherapy for Tissue Repair and Pain Relief

Chukuka S. Enwemeka, PhD, FACSM,^{1,2}

Andras M. Fulop, DPT,² Seema Dhimmer, DPT,² James R. Deluca, DPT,² David D. Johanson, DPT,²
Richard V. Lenz, DPT,² Keyuri B. Patel, DPT,² Peter C. Douris, DPT, EdD,²

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Background: Endre Mester of Hungary first demonstrated the healing effects of laser phototherapy over 40 years ago, and Friedrich Plog of Canada showed in the mid-1980s that monochromatic light can be an effective alternative to invasive needle acupuncture for pain relief. However, there remains skepticism concerning the clinical value of phototherapy. Objective: This paper presents an overview of the literature concerning tissue repair and pain relief. In particular, because objective quantitative assessment of the treatment for tissue repair and pain relief is scarce, it presents two recent meta-analysis of the literature in greater detail. Concerning our meta-analysis, our aims were to test the null hypothesis that phototherapy has no significant positive effect on tissue repair (first study) and pain relief (second study), and hence determine if the current literature supports the use of phototherapy for either tissue repair or pain relief. Methods: Relevant original studies were gathered from every available source and coded. Papers that met pre-established inclusion criteria were subjected to statistical meta-analysis, using Cohen's *d* statistic to determine treatment effect sizes. Results: The overall trend of the literature will be detailed; however, concerning our meta-analysis for tissue repair, 70 effect sizes were computed from the 23 papers that met the inclusion criteria. The overall mean effect obtained was highly significant, $d = +1.94$ (95% confidence interval = (0.58–2.50). Further analyses revealed a similarly positive effect of phototherapy on tissue repair in experimental animal studies, $d = +2.60$, and a small to moderately positive effect in human cases of tissue repair, $d = +0.34$. The fail-safe number associated with the overall effect was 869; i.e., the number of additional studies in which phototherapy has negative or no effect on wound healing needed to negate the overall large effect size of +1.94. In our meta-analysis for pain relief, 52 effect sizes were computed from the 22 papers that met the inclusion criteria. The resulting overall mean effect size was highly significant; $d = +0.84$ (95% confidence interval = 0.44 to 1.23). The Fail-Safe number associated with the overall treatment effect, i.e., the number of additional studies in which phototherapy has negative or no effect on pain needed to negate the overall large effect size of +0.84, was 348. Conclusions: These findings indicate that phototherapy is highly effective for tissue repair, with stronger supporting evidence resulting from animal experiments than human studies. Furthermore, phototherapy effectively relieves pain of various etiologies; making it an invaluable addition to contemporary pain management strategies.

27P1445 Ribeiro

Abstract presentation

Title: **A case series of gingival depigmentation by laser: clinical findings and patients responses.**

Author(s): Martha S. Ribeiro¹, Aguinaldo S. Garcez², Silvia C. Nunez³. ¹ Centro de lasers e Aplicações. IPEN/CNEN-SP. São Paulo SP – Brazil. ² Centro de pesquisas e pós-graduação São Leopoldo Mandic.

Campinas SP. Brazil. ³ Centro de estudos, treinamento e aperfeiçoamento em Odontologia – CETAO. São Paulo SP – Brazil.

Background and objective: Although gingival physiologic melanin pigmentation is not a medical problem, complaints about "dark gums" are common. Gingival depigmentation has been carried out using surgical procedures. Recently, laser ablation has been recognized as one of the most effective, comfortable and reliable technique. The purpose of this study was to report removal of gingival melanin pigmentation using 3 different lasers wavelengths in a short-term clinical observation. Methods: The study included patients who requested cosmetic therapy for melanin pigmented gums. Treatment was carried out using an Er:YAG, a Nd:YAG and a diode laser. The Er:YAG laser beam was used defocused, in the other hand, the Nd:YAG and the Diode laser were used in contact mode. The "brush" technique was applied until the gingival surface appeared clinically free of pigmentation. Patients were observed for 1 month. Each patient filled out a personal evaluation questionnaire for clinical analysis. Results: Healing was uneventful and required no supportive therapy. None of the patients experienced severe pain during or post-operatively. Mild pain or itching was common during the first days. Conclusion: Depigmentation of gingival melanin pigmentation by laser radiation was a safe and effective procedure. According to the patients the esthetic results, for all the lasers used were comfortable and healing was uneventful.

27P1500 Alijanpour / Mokmeli

Abstract presentation

Title: **Successful white hair removal after coloring using Intense Pulse Light (IPL)**

Author(s): Robabeh Alijanpour M.D ^{1*}, Soheila Mokmeli M.D

Background & Objective: Despite newer and successful laser treatment modalities, efficacy of such equipments in white and depigmented hair removal is not remarkable. We aimed to introduce a new method adjunct to Laser therapy to achieve better outcome in order to eliminate facial white hair.

Method: This randomized clinical trial enrolled female patients suffered from hirsutism seeking for excess hair removal. They assigned to receive IPL (WL : 530_1200 nm, Epsilon, Italy) after coloring white hairs with either black eyebrow pencil or black hair color 2 days before intervention. The treatment accomplished by IPL with energy fluency of 40 J/cm², pulse duration 5 ms, pause 20 ms and pulse repetition rate 0.25 Hz with 4 wks interval for a total number of 6 sessions for both groups. We defined response to IPL therapy as poor for <30%, fair for 31-60% and good response for >60% white hairs removal in predefined area over facial skin.

Results: A total number of 62 female patients included in the study, 31 individuals in each group. Individual responses observed in eyebrow pencil group were 1(3%), 17(55%) and 13 (42%) patients with poor, fair and good responses respectively. More over in hair color group 1(3%), 15(48.5%) and 15(48.5%) patients responses as poor, fair and good respectively. There was no statistically significant difference in average hair elimination in two groups (P =0.419). No adverse events reported.

Conclusion: The result of this study clarified that this unique method is efficient and safe for excess white hair removal.

27P1515 Peter Gal

Title: **Low-level laser therapy at 635 and 670 nm for treatment of excisional and incisional skin wounds in a rat model**

Author(s): Peter Gál^{1,2,3}, Michal Mokřý², Boris Vidinský², Tomáš Vasilenko^{1,2}, Kamila Lacjaková², František Longauer⁴, Ľudovít Lenhardt³, František Sabol⁵. ¹Department for Biomedical Research, ⁵Clinic of Heart Surgery, The East-Slovak Institute for Cardiovascular Diseases, Košice, Slovak Republic

²Department of Medical Biophysics, ⁴Department of Forensic Medicine, Pavol Jozef Šafárik University, Košice, Slovak Republic. ³Department of Pathological Anatomy, University of Veterinary Medicine and Pharmacy, Košice, Slovak Republic.

Background and Objectives: Optimal parameters of low-level laser therapy (LLLT) for respective wound type are still unknown. Hence, our study was aimed to compare effects of different power densities of LLLT at 635 and 670 nm (daily dose = 5 J/cm²) on excisional and incisional wound healing in rats.

Methods: Four, round, full-thickness, skin wounds were made on the backs of 48 rats that were divided into two groups (635 and 670 nm laser-treated). Wounds were daily stimulated with different power densities. 2, 6, and 14 days after surgery, eight animals from each group were killed and samples removed for histological evaluation. Moreover, one full-thickness skin incision was performed on the back of another 40 rats and immediately sutured. Wounds were daily stimulated either with 635 or 670 nm laser light. Seven days after surgery each wound was removed for wound tensile strength measurement.

Results: Whereas in the excisional wound healing model both the 635 and 670 nm lasers significantly improved wound healing by using higher tested power densities (shortened process of inflammation, accelerated process of re-epithelization, granulation tissue and collagen formation), in the incisional healing model the wound tensile strength was significantly increased differently, i.e. the 635 nm laser improved healing by using higher tested power density the 670 nm laser improved healing using lower power density.

Conclusion: In conclusion, LLLT, by the method we used, improved wound healing in rats.

Nevertheless, different LLLT parameters were suggested by the ~~Iranian Medical Laser Association~~ ^{Iranian Medical Laser Association}, Tehran, Iran. Iranian Medical Laser Association, Tehran, Iran.

27P1530 Majlesi

Abstract presentation

Title: Changes in laser-tissue interactions on a wide spectrum of power densities ended close to high power

Author: GHOLAMREZA MAJLESI M.D.

Abstract: Since 4.5 years ago we have had about 700 cases of facial rejuvenation and skin tightening of the body by low power lasers. Methods have been progressively developed and new instruments added as well and subsequently results have been enhanced. Shifting from one laser to another or addition of a new device not only enhanced results but revealed some new findings in endless world of the laser as well.

After tens of cases of rejuvenation by GaAlAs(808nm,1 W) together with a vacuum, InAlGaP, 635nm, 25mW, was added(both in scan mode). Significantly results was changed as increased tightness and more persistency of results.

In the next step, properties of InAlGaAs was changed to collimated, 150mW. Not only results in rejuvenation was increased, but new unwanted but desirable phenomena was welcome; lightening of skin and lightening of pigmented lesions of irradiated area although dose and total energy were not changed.

Are there changes in laser-tissue interaction when power and power density is changing? Can we conclude that on a spectrum from low power to high power behavior of laser in tissue is changing gradually as well?

In this way we have chose another point on this development; fractional Co₂ laser with a power and distance (between probe and tissue) which acts as low power but close to high power(results seem to be different but will be completely analyzed till a couple of weeks).

In order to compare collimated and usual laser light, it is irradiated to a piece of live tissue just after resection in a surgery. Result of these observations was changes in laser- tissue interaction. Probably we can conclude that different power densities have different effects on tissue.

Pre conditioning and low level laser therapy in dental practice

Dr. Arun Darbar Dental Surgeon DGDP
Dr. Rita Darbar Orthodontist D Orth RCS

BACKGROUND: Lasers have been used in our clinical dental practice for the past 20 years for dental procedures. Low level laser therapy became a natural progression as the benefits to patients in combination with surgical and hard tissue applications were noted consistently. This has now been taken a step further and the use of laser therapy prior to treatment to prime the tissue before any intervention is tested.

METHODS: The parameters used and the clinical results are demonstrated with slides and macroscopic changes using videos with high magnification

ABSTRACT: The purpose of this clinical presentation is to demonstrate how this concept has improved the patient experience. As clinicians we continue to strive to treat our patients with minimum discomfort and get predictable good quality outcomes. As it has been shown that low level lasers can affect the redox balance of the cell we hypothesise that if we can change this balance favourably by preconditioning before any intervention it is possible that we can promote even better quality healing and prepare the tissue to respond more favourably. Cases treated in our dental practice will be demonstrated with the protocols used. A look at the science behind this concept will be examined in an effort to explain the results and to open discussion.

Keynote speaker

“Development of WALT-guidelines – Past and future issues”

Jan Magnus Bjordal

The first WALT dosage recommendations were published in August 2005 for musculoskeletal pain disorders in accordance with the AGREE instrument. The guidelines are the product of the combined efforts of a core group of 6 LLLT experts who has no conflicts of interests with laser manufacturers, and who have between 6 and 21 years academic and/or clinical experience with LLLT.

The first step in the procedure was the categorisation of laser types and their respective biophysical properties and their respective credible biological mechanisms of LLLT. The second step in the procedure was to identify therapeutic windows from two or more controlled laboratory trials with. This evidence formed the base of knowledge which every WALT guideline rest upon. Tentative optimal treatment dosage tables are then made for each laser type and each site of pathology and the pathological features of the condition. In the fifth step, randomised placebo-controlled clinical trials are assessed for trial methodology and adequacy of treatment procedure and dose according to the CONSORT and QUORUM statements. In the sixth step, trials of acceptable quality are subject to meta-analyses and subgroup analyses are performed for different doses. Suggested guidelines are then formed from the direct evidence provided by the meta-analyses results. In restricted cases where the available evidence allow these results to be extrapolated, a limited number of diagnoses involving other anatomical locations are added when tissue properties and pathology were considered similar. The initial guidelines, were seconded by the 13 scientific advisors to WALT, a panel of clinical experts and the boards of WALT, before being published at the WALT website.

In the period of time which has elapsed since the first publication in 2005, only minor adjustments have been made of these guidelines. Moreover, newly published systematic reviews have confirmed that WALT guidelines are valid and that the WALT recommendations yield significantly better results than other doses and irradiation procedures. As the validity of the WALT recommendations now has been confirmed, a set of new WALT guidelines for oral mucositis and acute soft tissue injuries are being presented at the WALT2010 congress.

(Brown)

Basic Science

28B0915 Chavantes

Abstract presentation

Title: Low-level Laser Therapy in Chronic Autoimmune Thyroiditis: Initial Results

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Background and objective: Chronic autoimmune thyroiditis (CAT) is the most common cause of acquired hypothyroidism, which requires continuous treatment with levothyroxine (LT4). The objective of this study is to evaluate the effectiveness of the low-level laser therapy (LLL) in CAT patients with hypothyroidism through thyroid function.

Methods: Randomized, placebo-controlled trial with 6 months of follow-up. Forty three patients presenting hypothyroidism caused by CAT using LT4 were randomized in two groups: LLL (L=23, mean age 44±4.1), and placebo (P=20, mean age 42±5.1). A diode laser (beam area 0.02827cm²) with

placebo function was utilized. Both group patients received 10 treatment applications (punctual technique in continuous mode, twice a week). Placebo was treated with red ordinary light and LLLT with 830nm light, output power=50mW, fluence=70J/cm². Thirty days post-interventions, LT4 was discontinued in all patients and, if required, reintroduced. Concentrations of triiodothyronine (T₃), thyroxine (T₄), free T₄, thyrotropin (TSH) were determined pre- and 1, 2, 3 and 6 months post-LT4 withdrawal.

Results: The LT4 dose was smaller in LLLT (36.43±20µg/day) than in P group (102.50±22µg/day; P<0.0001) in the sixth month of follow-up. In this time point all LLLT group patients showed reduction in LT4 dose, with 12/23 (52%) not needing LT4. The concentrations of T3 (P=0.21), T4 (P=0.47), free T4 (P=0.87) and TSH (P=0.24) were similar pre-LLLT and 6-month post-LT4 withdrawal. No adverse effects were observed in both groups.

Conclusion: LLLT was effective to promote improvement of thyroid function as there was a decrease in the need for LT4, suggesting tissue regeneration in CAT patients.

28B0930 Ailioaie

Abstract presentation

Title: **Photobiostimulation and Self-organization Phenomena at Cellular Level in Medical Conditions**

Author(s): Laura Marinela Ailioaie¹, C. Ailioaie¹, D.A.Chiran¹, M. Sanduloviciu²

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Background and objective: The elucidation of the mechanisms through which photobiostimulation selectively affects the function of the living cells is essential for improving its efficiency in different medical conditions.

Methods: We propose a new conceptual model proving that a self-organized cell-like complexity "organically runs" or "lives" by emitting photons. Knowing the scenario of self-organization by which these complexities emerged we explain how laser irradiation, but also other physical agents, can affect the health condition of a living organism.

Results: We tentatively explained the following phenomena revealed by a living cell: how the electrical charge located in the structure of the cell nucleus is maintained constant by a continuously produced conversion of thermal energy in electric field energy; how the cell nucleus works as a micro-oscillator; why the biophotons emission takes place coherently.

Each cell nucleus emits information in the form of a bunch of coherent biophotons, but it is also able to absorb signals at resonance. So, different cells are able to exchange information. By laser irradiation it is possible to improve the electrical charging process of the nucleus that, in its turn, can enhance the stability of the genetic functions of the cell as a whole. Consequently, the specific resistance of the cell and, implicitly, its immune reactions increase.

Conclusions: Starting from the premise that the operations performed by living cells are governed by an algorithm of instructions encoded in the "microcomputer" located in the nucleus of the cell we explained how laser irradiation can affect these operations.

28B0945 Chavantes

Abstract presentation

Title: **CAN LOW LEVEL LASER THERAPY RELIEVE EXCRUTIATED PAIN CAUSED BY VENTRICULOPERITONEAL SHUNT ?**

Author(s): Nathali Cordeiro Pinto¹; Liliam R.Santos¹, Fernando C. G. Pinto²; M.C. Chavantes¹. 1 - Medical Laser Center of Heart Institute (InCor), Clinical Hospital, Medical School, University of São Paulo. São Paulo, SP, Brazil. 2 - Division of Functional Neurosurgery of the Institute of Psychiatry, Medical School, University of São Paulo, São Paulo, SP, Brazil.

Background and Objective: Ventriculoperitoneal shunting (VPS) is a surgical procedure to relieve the increased pressure inside the skull, caused by hydrocephalus, which is the excess of cerebrospinal fluid (CSF) on the brain. CSF drained through a catheter shunt that is allocated into the subcutaneous

tissue, under the skin, from the brain area to the abdominal cavity. After several years there are a number of complications associated with shunt placement. The headache is the most common symptom, usually associated with shunt stopping. Fibrosis following the catheter trajectory, from skull to thoracic and peritoneal area, can lead to an unbearable constant pain. Low Level Laser Therapy (LLLT) has been used to assist several processes, leading to successful antiinflammatory and analgesic effect. The aim is to evaluate LLLT effect against constant lancinating pain caused by VPS.

Methods: Pilot study with three patients relating “pin” and “burning” all through the VPS catheter for a long lasting period without response to potent analgesic drug has been analyzed. All had the highest average (10) in Visual Analogue Scale (VAS) before Laser application. Patients were evaluated pre and post Diode laser applications, with red wavelength, $P=15\text{mW}$, $DE=7.5\text{J}/\text{cm}^2$, $T=20\text{s}$, punctually on painful region, once a week.

Results: All patients presented an expressive pain remission with relapse of all symptoms with follow-up of 12 months up till now.

Conclusion: LLLT can be a safe, non-invasive and useful tool, when all other actions have failed. Thus, Lasertherapy contributed to improve the patients’ quality of life, especially, preventing unnecessary risky surgery.

28B1000 Chavantes

Abstract presentation

Title: LOW LEVEL LASER THERAPY AS A NEW OPTION FOR TREATING CHRONIC PAIN IN STERNOTOMY AFTER CARDIAC SURGERY.

Author(s): Nathali Cordeiro Pinto¹; Mara Helena Corso Pereira¹; Tais C. Genova¹; Noedir Groppo Stolf²; M.C. Chavantes¹. 1 - Medical Laser Center of Heart Institute (InCor), Clinical Hospital, Medical School, University of São Paulo. São Paulo, SP, Brazil. 2 - Cardiovascular Surgery, Department of Heart Institute – Clinical Hospital, Medical School, University of São Paulo. São Paulo, SP, Brazil.

Background and Objective: Pain originated from post operative (PO) routine procedure associated to large nociceptive stimulus of sternotomy has diverse organic consequences. The failure to administer the correct due treatment may result in chronic pain. Published studies correlated that 51% of patients still had pain in sternotomy area on 7th PO and persistent pain still included 33% after 12 months post Cardiac Surgery. The application of several analgesic techniques can often cause intense systemic side effects and limitations. LLLT has been proven to be a preventive tool of pain in cases of post-cardiovascular surgery. The aim is to evaluate LLLT response in patients with chronic pain that underwent to sternotomy after cardiac surgery.

Methods: Pilot study in patients relating “pin” and “electrical shock” sensation in scar area for a long lasting period with no analgesic therapy response denoted a high average in Visual Analogue Scale (VAS), resulting in severe problems in Activities of Daily Living [ADLs] (Barthel and Lawton’s Scales). Patients were evaluated pre and post-Diode laser section, $\lambda=830\text{nm}$, $DE=25\text{J}/\text{cm}^2$, $P=35\text{mW}$, $T=21\text{s}$, once a week.

Results: Our study showed an expressive remission in pain symptoms since the very first day of therapy (VAS and ADLs assessment), and were discharged with total relapse of all symptoms up till now with 12 months follow-up.

Conclusion: The outcome indicates that LLLT is a new therapeutic tool, able to reduce pain without side effects and as non-invasive safe technique. LLLT ultimately facilitates and accelerates patients’ return to ADLs.

(Green)

Musculoskeletal

28G0915 Ernesto Leal Junior

Abstract presentation

Title: Comparison between light emitting diode therapy (LEDT) and cold water immersion therapy (CWIT) in short-term recovery of biochemical markers related to skeletal muscle restitution after high-intensity exercise in athletes - A pilot study

Author(s): Ernesto Cesar Pinto Leal Junior, Ph.D. ^{1*}, Rodrigo Álvaro Brandão Lopes-Martins, Ph.D. ^{1,2}, Vanessa de Godoi, PT ², José Luis Mancalossi, PT ³, Rafael Paolo Rossi, PT ², Thiago De Marchi, PT ^{3,4}, Douglas Grosselli, PE ³, Rafael Abeche Generosi, PE ⁵, Maira Basso, PT ³, Lucio Frigo, Ph.D. ⁶, Jan Magnus Bjordal, Ph.D. ^{7,8}. 1 - Center for Research and Innovation in Laser, Nove de Julho University (UNINOVE), São Paulo, SP - Brazil. 2 - Laboratory of Pharmacology and Experimental Therapeutics, Department of Pharmacology, Institute of Biomedical Sciences, University of São Paulo (USP), São Paulo, SP - Brazil. 3 - Laboratory of Human Movement (LMH), Sports Medicine Institute (IME), University of Caxias do Sul (UCS), Caxias do Sul, RS - Brazil. 4 - Laboratory of Oxidative Stress and Antioxidants, Institute of Biotechnology, University of Caxias do Sul (UCS), Caxias do Sul, RS - Brazil. 5 - Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS - Brazil. 6 - Biological Sciences and Health Center, Cruzeiro do Sul University, São Paulo, SP - Brazil. 7 - Section for Physiotherapy Science, Department of Public Health and Primary Health Care, Faculty of Medicine and Dentistry, University of Bergen, Bergen - Norway. 8 - Center for Evidence-Based Practice, Bergen University College, Bergen - Norway.

Objective: We aimed to compare the short-term effects of Light Emitting Diode Therapy (LEDT) and Cold Water Immersion Therapy (CWIT) after high-intensity exercise in biochemical markers related to skeletal muscle recovery. **Methods:** A randomized double-blind placebo-controlled crossover trial was performed with six male young futsal athletes. Their lower limbs were treated with CWIT (5° C of temperature [SD +/- 1°]), active LEDT (69 LEDs with wavelengths 660/850 nm, 10/30 mW of output power, 30 seconds of irradiation time per point, 41.7 J of energy irradiated per point, irradiated in 5 points bilaterally, 417 J of total energy irradiated) or an identical placebo LEDT five minutes after each of three Wingate cycle tests. Pre-exercise, post-exercise and post-treatment measurements were taken of blood lactate levels, Creatine Kinase (CK) activity and C-Reactive Protein (CRP) levels. **Results:** There were no significant differences in the work performed during the three Wingate tests ($p > 0.05$). All biochemical parameters increased from baseline values ($p < 0.05$) after the three exercise tests, but only active LEDT decreased blood lactate levels ($p = 0.0065$) and CK activity ($p = 0.0044$) significantly after treatment. There were no significant differences in CRP values after treatments. **Conclusion:** We conclude that treating the leg muscles with LEDT five minutes after the Wingate cycle test, seem to inhibit the expected post-exercise increase in blood lactate levels and CK activity. This suggests that LEDT has better potential than five minutes of CWIT for improving short-term post-exercise recovery.

28G0930 Luciano Ramos – Lopes-Martins

Abstract presentation

Title: The Effect of LLLT (810 nm) on inflammatory cytokines after controlled muscle strain in the tibial muscle of rats

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Background and objective: The objective of the study was to analyze the effect of LLLT on inflammatory cytokines after controlled muscle strain of the tibial muscle of rats. **Methods:** After

anesthesia, rats were fixed in a special table and received a non-invasive muscle traction corresponding to 150% of body weight during two periods of 20 minutes, with a 3 minutes interval. The tissue levels of TNF- α , IL-1, IL-6 and IL-10 were analysed. *Results:* LLLT was able to induce a significant inhibition of TNF- α : injury (846,60 \pm 34,2), injury + Diclofenac (99,2 \pm 32,1), injury + 1J (106 \pm 24,4), + 3J (193 \pm 51,1), injury + 6J (167,2 \pm 33,3) and injury + 9J (158,5 \pm 25,2). The same profile was observed to IL-1 β : injury (4233,8 \pm 140,64), injury + Diclofenac (1055,6 \pm 142,80), injury + 1J (708,40 \pm 173,66), + 3J (1034,0 \pm 243,89), injury + 6J (949,00 \pm 182,53) and injury + 9J (979,20 \pm 94,445). IL-6 was also significantly reduced: injury (1329,3 \pm 112,46), injury + Diclofenac (828,50 \pm 226,24), injury + 1J (390,50 \pm 68,921), + 3J (324,50 \pm 12,168), injury + 6J (348,57 \pm 29,661) and injury + 9J (401,00 \pm 27,492). *Conclusion:* Our Results clearly demonstrate that The Low Level Laser Therapy modulates the synthesis of inflammatory cytokines, contributing to the anti-inflammatory effect of the therapy.

28G0945 Ernesto Leal Junior

Abstract presentation

Title: Effects of low-level laser therapy (LLLT) in the development of exercise-induced skeletal muscle fatigue and changes in biochemical markers related to short-term post-exercise recovery

Author(s): Ernesto Cesar Pinto Leal Junior, Ph.D. ^{1*}, Rodrigo Álvaro Brandão Lopes-Martins, Ph.D. ^{1,2}, Lucio Frigo, Ph.D. ³, Thiago De Marchi, PT ^{4,5}, Rafael Paolo Rossi, PT ²,

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Background: Cell and animal studies have suggested that LLLT can reduce oxidative stress and inflammatory responses in muscle tissue. But it remains uncertain whether these findings can translate into humans in sport and exercise situations.

Objective: To investigate if low-level laser therapy (LLLT) can affect biceps muscle performance, fatigue development, and biochemical markers of post-exercise recovery.

Methods: Nine healthy male volleyball players participated in the study. They received either active LLLT (cluster probe with 5 laser diodes, $\lambda=810$ nm, 200 mW, 30 seconds of irradiation, applied in 2 locations over the biceps of the non-dominant arm, 60 J of total energy) or placebo LLLT using an identical cluster probe. All subjects performed voluntary elbow flexion repetitions with a workload of 75% observed in their 1 repetition maximum test (1 RM).

Results: Active LLLT increased the number of repetitions by 14.5% (mean of 39.56, SD +/- 4.33 versus 34.56 +/- 5.64, $p=0.037$) and the elapsed time before exhaustion by 8.0% ($p=0.034$), when compared to the placebo treatment. The biochemical markers also indicated that short-term recovery may be positively affected by LLLT as indicated by post-exercise blood lactate levels ($p<0.01$), Creatine Kinase (CK) activity ($p=0.017$), and C-Reactive Protein (CRP) levels ($p=0.047$) showing a faster recovery with LLLT application prior to the exercise.

Conclusion: We conclude that pre-exercise irradiation of the biceps with LLLT dose of 30 J per application location, applied in 2 locations, increased endurance for repeated elbow flexion against resistance, and decreased post-exercise levels of blood lactate, CK, and CRP.

Key words: Biceps, Skeletal muscle performance, Skeletal muscle damage.

28G1000 Bjordal

Title: Low-Level Laser Therapy (LLLT) in Acute Soft-tissue Injuries

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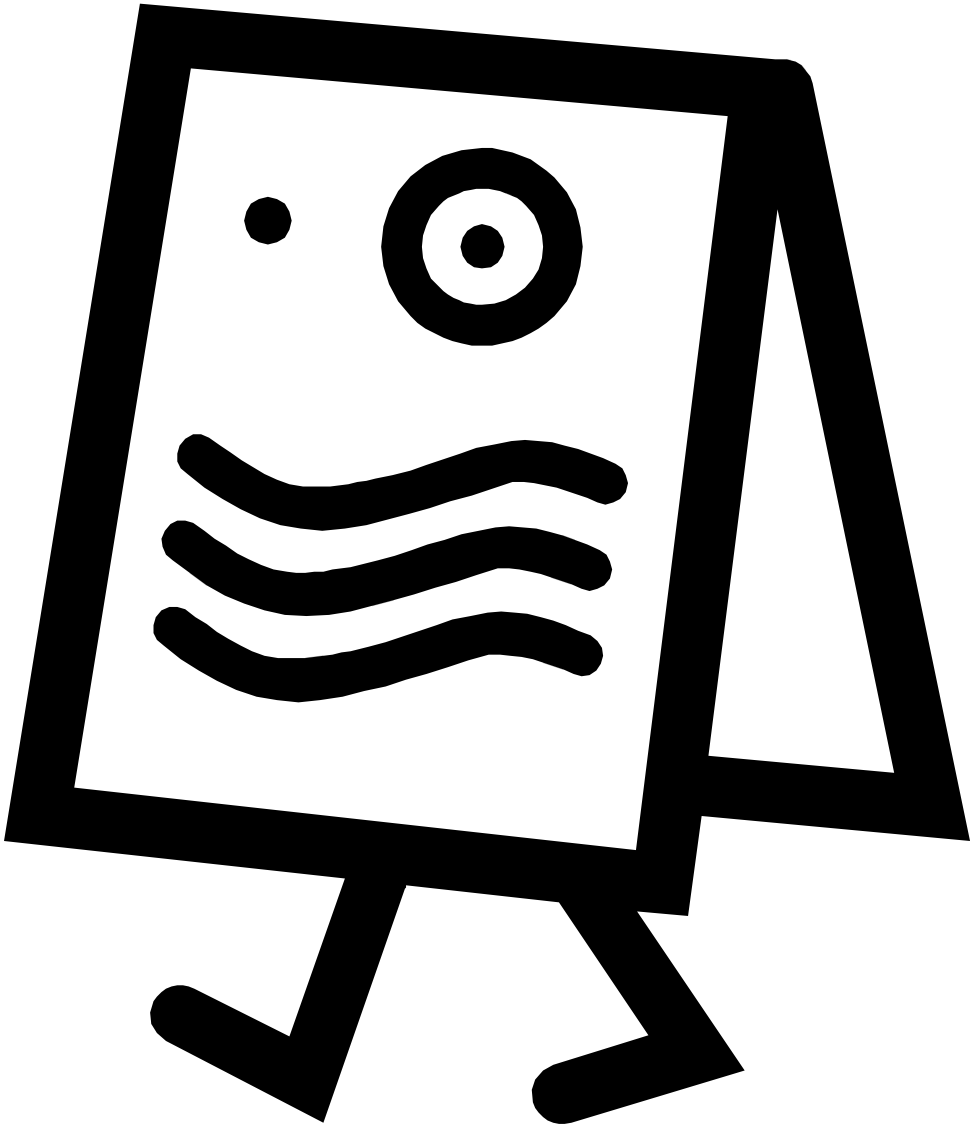
Background: There is strong evidence from 44 controlled laboratory studies that LLLT can modulate inflammatory pain by reducing levels of biochemical markers (PGE 2, mRNA

Cox 2, IL-1 α , TNF-alpha), neutrophil cell influx, oxidative stress, and the formation of edema and hemorrhage in a dose- dependent manner (median dose 7.5 J/cm², range 0.3–19 J/cm²). Animal studies with optimal doses of LLLT appear to be equally effective as non-steroidal anti-inflammatory drugs (NSAIDs).

Purpose: The aim of this study was to review the clinical short-term effects of LLLT in acute pain from soft-tissue injury.

Methods: Literature search of randomized placebo-controlled clinical trials, which measured outcomes within the first 7 days after acute soft-tissue injury. *Results:* Eight randomized placebo-controlled trials found no significant results after irradiating only a single point on the skin overlying the site of injury, or by using a total energy dose below 5 Joules. Nine randomized placebo-controlled trials ($n= 609$) were of acceptable methodological quality, and irradiated three or more points and/or more than 2.5 cm² at the site of injury or surgical incision, with a total energy of 5.0–19.5 Joules. Results in these nine trials were significantly in favor of LLLT over placebo in 15 out of 18 outcome comparisons. Poor and heterogeneous data presentation hampered statistical pooling of continuous data. Categorical data of subjective improvement from four trials revealed a significant relative risk for improvement in favour of LLLT.

Conclusion: LLLT can reduce acute soft-tissue pain in clinical settings in a dose-dependent manner. More clinical trials with adequate LLLT doses are needed to precisely estimate the effect size for LLLT in.



Poster Abstract

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Title: Low Intensity Laser Therapy (LILT) in vivo acts on the neutrophils recruitment and chemokines/cytokines levels in a model of acute pulmonary inflammation induced by aerosol of lipopolysaccharide from Escherichia coli in rat

Author(s): F. Mafra de Lima¹, R. Albertini², A. B. Villaverde³, M. A. Salgado⁴, H. C. Castro-Faria-Neto⁵, E. Munin³, F. Aimbire³ - ¹Institute of Research and Development, Av. Shishima Hifumi, 2911, Urbanova, CEP: 12.244-000, São José dos Campos, SP, Brazil; ²Rehabilitation Sciences Department, Centro Universitário Nove de Julho - Uninove. Rua Vergueiro, 235, SP, Brazil; ³Institute of Biomedical Engineering, UNICASTELO, Km 138, Via Dutra, CEP: 12.247-004, São José dos Campos, SP, Brazil; ⁴Department of Histology, Faculty of Dentistry, UNESP, Av. Eng. Francisco José Longo, 777, São José dos Campos, SP, Brazil; ⁵Laboratory of Immunopharmacology, FIOCRUZ, Po Box 926, CEP: 21045-900, Rio de Janeiro, RJ, Brazil.

Background and objective: It has been suggested that low intensity laser therapy (LILT) acts on pulmonary inflammation. Thus, we investigate in this work if LILT (660 nm) can attenuate edema, neutrophil recruitment and inflammatory mediators in acute lung inflammation.

Methods: Male Wistar rats were exposed to aerosolized lipopolysaccharide (LPS) and then treated with LILT. Airway inflammatory was measured 4 h post LPS. Pulmonary microvascular leakage was used for measuring of pulmonary edema. Bronchoalveolar lavage fluid (BALF) cellularity and myeloperoxidase (MPO) were used for measuring of neutrophil recruitment and activation. RT-PCR was performed in lung tissue to assess mRNA expression of tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), interleukin (IL-10), cytokine-induced neutrophil chemoattractant-1 (CINC-1), macrophage inflammatory protein-2 (MIP-2) and intercellular adhesion molecule-1 (ICAM-1). Protein levels both BALF and lung were determined by ELISA.

Results: LILT inhibited pulmonary edema and endothelial cytoskeleton damage, as well as neutrophil influx and activation. Similarly the LILT reduced the TNF- α and IL-1 β , in lung and BALF. LILT prevented lung ICAM-1 up-regulation. The rise of CINC-1 and MIP-2 protein levels both lung and BALF was unaffected, thus like the lung mRNA expressions for IL-10.

Conclusion: Data suggest that the LILT effect on acute lung inflammation is due to the inhibition of ICAM-1 via the inhibition of TNF- α and IL-1 β .

Title: Anti-Inflammatory Effects of Low-Level Light Emitting Diode Therapy on Achilles Tendinitis in Rats

Author(s): M. Xavier^{1, 2}, D. David¹, R. de Souza^{1,2}, A. Arrieiro², H. Miranda¹, E. Santana², T. Araújo³, J. Silva Jr ³, F. Aimbire⁴, R. Albertini³ - ¹Institute of Research and Development, IP&D, Vale do Paraíba University, UNIVAP, Av. Shishima Hifumi, 2911, 12244-000, São José dos Campos, São Paulo, Brazil; ²Department of Physical Therapy, Vales do Jequitinhonha e Mucuri Federal University, UFMJM, Rua da Glória, 187, 39100-000, Diamantina, Minas Gerais, Brazil; ³Departamento de Ciências da Reabilitação, Centro Universitário Nove de Julho, UNINOVE, Rua Vergueiro, São Paulo, SP, Brazil; ⁴Universidade Camilo Castelo Branco, UNICASTELO, Rodovia BR-116, São José dos Campos, São Paulo, Brazil

Background and objective: The present study investigated the effects of low-level LED therapy (880 \pm 10nm) on inflammatory process in a experimental model of Achilles tendinitis induced by collagenase.

Methods: Fifty-six male Wistar were separated into seven groups (n=8), three groups in the experimental period of 7 days and four groups in the experimental period of 14 days, the control group (CONT), tendinitis group (TEND), LED therapy group (LEDT) for both experimental periods and LED therapy group 7th to 14th day (LEDT delay) for 14 days experimental period. The LED parameters was 22 mW CW of optical output power, distributed in an irradiation area of 0.5 cm², with an irradiation time of 170s, the applied energy density was 7.5 J/cm² in contact; The therapy was initiated 12h after the tendinitis induction, with a 48-hour interval between the irradiations. The histological analysis and inflammatory mediators were quantified.

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Results: Our results showed that LED, decrease the inflammatory cells influx and mRNA expression to IL-1 β , IL-6, TNF- α in both phase, and COX-2 just in initial phase ($p < 0.05$).

Conclusion: We can conclude that the LED was able to reduce signs of inflammation in collagenase-induced tendinitis in rats by reducing the number of inflammatory cells and decrease mRNA expression of cytokines.

Title: **Assessment of bactericidal effect of photodynamic therapy on streptococcus mutans (An In vivo Study)**

Author(s): Presenter :Ali Saafan Associate professor of dental laser applications ,National institute of laser enhanced sciences (N.I.L.E.S) Cairo University .

Co-authors:Nadia Ezz El Din Metwalli professor of pediatric dentistry Faculty of Dentistry ,Ain Shams University . Amr M. Abdel Aziz professor of pediatric dentistry Faculty of Dentistry. ,Ain Shams University . Dalia Fakh El BedawiB.D.S. Cairo University .

Background and objective: Dental caries may be defined as a bacterial disease of the calcified tissues of the teeth .Streptococcus mutans can be considered as the major pathogens associate with caries in humans and also able to induce carious lesions in experimental animal .Significant decreases in the viability of S.mutans biofilms were observed when biofilms were exposed to photodynamic therapy (PDT).

Methods: A forty five child with simple class one carious molar were divided into three groups . Methylene blue (MB) was applied to the carious cavities (concentration of 100ug/ml) . Diode laser (650nm) was applied with average energies 4.8 J (group I), 9.6 J (Group II) and 14.4 J (group III) respectively . Dentine samples were collected using a sterile sharp spoon excavator before and after laser irradiation for microbiological study.

Results: Statistical analysis of the collected data revealed a significant bactericidal effect of all the treated groups with maximum bactericidal effect (85.6%) with 14.4 J irradiation and minimum effect with 4.8 J irradiation (38.8) .

Conclusion: Under the circumstances of this study , we can conclude that Photodynamic therapy can be considered as a promising effective technique , that may play a role in the atraumatic restorative dentistry

Title: **INNOVATIVE NEW NEAR INFRARED LASER BASED TRANSILLUMINATION SYSTEM FOR CARIES DETECTION**

Author(s): Almeida-Lopes, Luciana^{1*}; Mancini, M.W.¹; Pretel, H^{1,2}.; Barbano, E.C.³; Trevelin, L.C.⁴; Moreira, J.⁴; Salvadeo, D. H. P.⁴; Papotti, P.E.⁴; Dias, R.L.⁴

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Abstract: Different methods have been proposed in order to allow for enhanced diagnostic of dental caries by using non-ionizing electromagnetic sources. Most of them are based on light induced fluorescence (LIF), allowing for information from both fluorescence images and spectroscopic measurements, optical coherence tomography (OCT) and transillumination (TI). Oppositely to the fluorescence methods, that do not present any direct correlation to the caries demineralization process, the TI method is based on the enhanced scattering properties of demineralized hard tissues in contrast to sound tissue that leads to the observed contrast in the TI dental images. As for TI purposes, the near infrared (NIR) region of the electromagnetic spectrum is the most suitable due to the highest enamel and dentin transparency to light, allowing for better image quality in comparison to that obtained by using visible wavelengths. We have used a 808 nm fiber-coupled diode laser source providing 100 mW maximum output power (Thera Lase - DMC) for transillumination of dental elements and a CCD device camera in order to obtain information on several types of caries lesions including: incipient caries lesions on the occlusal surface, proximal lesions, in-depth examination of

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morphological details on the enamel surface, namely cracks and early fractures, as well as detailed assessment of the restoration-enamel boundaries whose defects can lead to secondary caries. Hidden caries in dentin and secondary caries were observed as well. Image processing has been used to treat and analyze NIR images in order to obtain information on the shape and evolution level of dental lesions from the laser based transillumination images. In addition to be a non-invasive and non-ionizing, NIR laser TI (NIR LTI) method has proven to have potential to provide both qualitative and quantitative information as an improved diagnostic tool of dental caries in comparison to the current clinically available methods.

Title: DEVELOPMENT OF A DYE EXTRACTED FROM JENIPAPO FRUIT TO BE USED FOR PHOTODYNAMIC THERAPY (PDT)

Author(s): Almeida-Lopes, Luciana*; Pretel, H.; Napolitano, M.A.; Mancini, M.W. ¹NUPEN – Research and Education Center for Photo Therapy in Health Sciences, São Carlos, Brazil. *Rua Vitório Giometti, 780 - CEP.13564.305 São Carlos – Brazil.

Photodynamic therapy (PDT) with antimicrobial purposes is well established in the literature. Their action on Gram positive and Gram negative bacteria are reported with great success, especially in cases of localized infections, surface microflora and known to those occurring in the oral cavity (Wilson et al. 1993; Dortbudak et al. 2001; Chan & Lay, 2003). The project goal is to evaluate the potential of the fruit of Jenipapo (*G. americana* L.) as a source of natural blue dye for the development of a natural photosensitizer to use the technique of photodynamic therapy (PDT) antimicrobial. The first phase of the project consisted of: 1 - Develop the technology and specific solvent for the extraction of dye jenipapo; 2 - To quantify the concentration and color ideal for use in PDT, 3 - Evaluate the ideal wavelength of laser irradiation in order to obtain a resonant absorption band for the solution of the extract Jenipapo. The extraction of the Jenipapo was obtained from the pulp of unripe fruit. The content was crushed in the presence of different solvents and concentrations (water and ethanol), which showed the molecule blue geniposide. At this stage various concentrations were obtained to compare the stability and effectiveness of the technique (PDT). Analysis under spectrophotometer were then conducted in order to verify the absorption behavior of the dye in a gel. After all the phase analysis of the project was concluded that the result of chemical feasibility Jenipapo can be used as a antimicrobial photosensitizer in PDT. Microbiological studies and cytotoxicity are going to be carried out in phase 2 of the project to assess the effectiveness of the PDT treatment with the technique using natural dye extracted from the fruit of Jenipapo.

Title: Variation in low power laser dose response with skin type

Author(s): Ann Liebert - Physiotherapist, Private Practice, Sydney Australia; Dr Roger Adams University of Sydney ; Professor Gordon Waddington - University of Canberra, ACT 2601;

Background and objective: The aim of this project is to enhance current knowledge regarding the effective use of low power laser treatment of patients in clinical practice. Low power laser treatment in the therapeutic band of 630-910nm wavelength has been widespread in physiotherapy use for over 20 years. These conditions include pain, wound healing and inflammatory joint and tendon conditions. The aim of this study was to determine if there was any difference in the absorption of laser in subjects with distinctly different skin pigment types.

Methods: Nine volunteers of three distinctly different skin types and with a Body Mass Index of less than 30, were subjected to a two second dose of a 904 nanometre 60 milliwatt laser applied through the cheek. The location of the laser penetration was pinpointed in each subject using anatomical markers to ensure that the subcutaneous tissue was comparable in all subjects. The residual output was measured on the inside of the cheek using a calibrated output meter held in a purpose constructed rigid jig. The distance between the Irradia 904nm laser delivery system and the New

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Focus laser receiving sensor was always constant. This distance on all subjects was measured with a Mindray Ultrasound.

Results: Amount of laser radiation absorbed by cheek pouches with different skin surface pigmentation was compared using 95% confidence intervals. Results were interpreted in terms of their implications for settings in clinical laser administration.

Conclusion: The effective use of laser requires the consideration of individual skin types in dose prescription.

Title: Selective laser removal of carious dentin based on mid infrared tissue optical properties

Author(s): Kunio Awazu^{1,2}), Katsunori Ishii ¹), Masyuki Saiki ¹), Kazuyo Yamamoto ³), Kazushi Yoshikawa ³) ¹)Medical beam physics lab., GSE, Osaka University, Japan ²)SENTAN, Japan Science and Technology Agency (JST), Tokyo, Japan, ³) Osaka Dental University, Japan

Background and objective: Selective removal of carious dentin without side effects using a novel mid-infrared laser.

Methods: As carious dentin model, decalcified bovine dentin disks were exposed to a high-energy mid infrared tunable laser at power density of 5 to 25 [W/cm²] to estimate the removal threshold.

Results: The wavelength at 6.02 μm could remove a decalcified dentin selectively without a serious side effect to sound dentin (15 W/cm² X 20 s) .

Conclusion: Low power 6.02μm irradiation is the novel removal method for realizing minimal intervention of healthy dentin

Title: Low-level GaAlAs and InGaAlP lasers have no effect on myoblasts grown in a muscle injury model

Author(s): Kristianne P. S. Fernandes ^a, Raquel A. Mesquita-Ferrari ^a, Nadhia H. C. Souza ^b, Camila A. A. Silva ^b, Manoela D. Martins ^a, Sandra K. Bussadori ^a

^a PhD , Full Professor, Rehabilitation Sciences Department, Nove de Julho University

^b Student, School of Physiotherapy, Nove de Julho University

Background and objective: The question is no longer whether Low Level Laser Therapy (LLLT) has biological effects, but rather how radiation from therapeutic lasers and light-emitting diodes works at the cellular and organism levels and what the optimal light parameters are for different uses of these light sources at various wavelengths and for different kinds of cells and tissues. The aim of the present study was to evaluate the effect of LLLT on the proliferation of cultured C2C12 myoblasts under different nutritional conditions (muscle injury model) using low-level GaAlAs and InGaAlP lasers with different parameters and incubation periods. There are no data in the literature on C2C12 myoblasts proliferation following phototherapy with GaAlAs and InGaAlP lasers.

Methods: C2C12 cells cultured in regular and nutrient-deficient medium were irradiated with low-level GaAlAs (660 nm) and InGaAlP (780 nm) lasers with energy densities of 3.8, 6.3 and 10 J/cm², and 3.8, 10 and 17.5 J/cm², respectively. Cell proliferation was assessed 48 and 72 hours after irradiation by MTT assay

Results: There were no significant differences in cell proliferation between laser-treated myoblasts and control cultures for any of the parameters and incubation periods.

Conclusion: The data of present study reveal that LLLT employed under the parameters described does not alter C2C12 cell growth under either regular or nutrient-deficient culture conditions.

Title: Low level laser therapy with differences output power (40, 60, 80, 100mW) in calcaneus tendon repair: Realignment and collagen types.

Authors: Rafael C Gobbato, Carlos E Pinfieldi , Marco A Neves, Viviane T Wood, Nivaldo Parizoto, Bernardo Hochman, Lydia M Ferreira.

Background and objective: Calcaneus tendon is one of the most damaged tendons, and its healing may last from weeks to months to be completed. In the search after speeding tendon repair, low intensity laser therapy has shown favorable effect. The purpose of this study was to assess the effect

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of 40, 60, 80 and 100mW powers of low level laser on the process of tissue repair in partial lesion calcaneous tendon in rats

Methods: The laser used was (AsGaAL) 830nm, power density of 30J/cm² and 40mW, 60mW, 80mW and 100mW of power, for a period of 5 consecutive days including all groups. All animals underwent a partial lesion of the calcaneous tendon. On the 6th postoperative day, the tendons were removed and analyzed by using the polarized microscopy. The organization of collagen fibers was detected and measured through birefringence. The collagen type predominance in the calcaneous tendons was verified through the picosirius analysis

Results: The LLLT groups showed a significant improvement in the realignment of the collagen fibers, but there was no significant difference when they were compared together. While evaluating the amount of type III collagen, an increase was observed as the laser level increased (40 to 100mW). In type I collagen counting, the 80mW group presented significant results when compared to the sham group ((p=0, 05)

Conclusion: LLLT did not show any difference in the collagen fiber realignment with 40, 60, 80, 100mW powers, however, there was an increase in the production of type III collagen for the 60, 80 and 100mW groups and type I collagen for the 80mW group.

Title: Regulation of osteoblast differentiation by 635-nm irradiation in MC3T3-E1 cells supplemented with a high concentration of glucose

Author(s): [Hongran Choi](#)¹, Wonbong Lim¹, Inae Kim¹, Jisun Kim¹, Hyukil Kwon¹, Youngjong Ko¹, Sangwoo Kim¹, Misook Kim¹, SeoYune Kim¹, Xiaojie Li¹, Okjoon Kim¹

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Background and objective: Diabetic patients tend to exhibit delayed bone formation and osteoblast differentiation, which results in osteopenia. Recently, numerous clinical reports suggest that 635-nm light irradiation improves bone regeneration and wound healing, and reduces pain in patients suffering from diabetes. The purpose of the present study was to test the hypothesis that 635-nm irradiation can influence bone formation by MC3T3-E1 osteoblasts cultured on high concentrations of glucose (25 mmol/L D-glucose) in the presence or absence of phorbol 12-myristate 13-acetate (PMA), and to establish an *in vitro* pathological model of bone formation.

Methods: The effect of 635-nm irradiation on bone formation was investigated using Alizarin Red S staining, and alkaline phosphatase enzyme activity and calcium deposition assays. In addition, gene expression of the osteogenic markers BMP-2, osterix and osteocalcin were assayed by RT-PCR.

Results: Calcium deposition by MC3T3-E1 cells was reduced in the presence of high concentrations of glucose or by PMA supplementation. However, 635-nm irradiation led to an increase in calcium deposition by MC3T3 cells, followed by increased bone mineralization. mRNA expression of BMP-2 and osterix at an early stage and of osteocalcin at a late stage was significantly upregulated by 635-nm irradiation in MC3T3-E1 cells supplemented with high concentrations of glucose.

Conclusion: Irradiation at 635 nm increases bone mineralization in MC3T3-E1 cells cultured *in vitro* on high concentrations of glucose and alters osteogenic gene expression, which accelerates bone formation in hyperglycemic conditions.

Title: Laser Acupuncture for pediatric indications: what we can apply.

Author(s): [Insoo Jang](#); Changsop Yang, Department of Internal Medicine, College of Korean Medicine, Woosuk University, Jeonbuk, South Korea; Junwon Kang, Graduate School of Medical Science and Engineering, Korea Advanced Institute of Science and Technology(KAIST), Daejeon, South Korea; Hyeon Choi, R&D center, Hamsoa Oriental Clinic Network, Seoul, South Korea; Seungtaek Yu, Department of Pediatrics, School of Medicine, Wonkwang University, Jeonbuk, South Korea; Euihyoung Hwang, Department of Rehabilitation, College of Korean Medicine, Woosuk University Jeonbuk, South Korea.

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Background and objective: Laser acupuncture has been tried in an attempt to apply to many indications since the first procedure was reported by Plog in Canada in 1973. Initially, Plog used the term 'biophysical application of the laser beam' instead of 'laser acupuncture', and applied only for auricular acupuncture. Despite the mechanism is debatable, it has been used continuously in clinical fields. Because of the characters of laser acupuncture such as painless, non-traumatic, no inflammation and without children's fear of needles, it can be a fascinate modality to a pediatrician. **Methods and Results:** Through our systematic review, the potential indications of laser acupuncture in pediatrics are summarized that asthma, postoperative nausea and vomiting (PONV), headache, nocturnal enuresis and etc. In asthma, a report concluded that laser acupuncture may have a beneficial effect on bronchial hyperreactivity, whereas another reported negative. PONV is one of the most common complications of general anesthesia. Recently, the Society for Ambulatory Anesthesia ascertained the preventive effect of acupuncture in the PONV clinical practice guidelines. Some reports showed that laser acupuncture can prevent or reduce the PONV after surgery. A study for headache mentioned that laser acupuncture can provide benefit. In an equivalency test for nocturnal enuresis, laser acupuncture showed positive result.

Conclusion: Based on the evidence from RCTs, it is suggested that laser acupuncture may have applications in pediatric patients. However, because of insufficient clinical trials, the evidence still remains inconclusive. Further studies with larger sample sizes and various indications are warranted.

Title: The thermal effects of therapeutic lasers with 810 nm and 904 nm wavelengths on human skin.

Authors: Jon Joensen ^{a,b,*}, Jan Hendrik Demmink ^b, Mark I. Johnson ^c, Vegard V. Iversen ^d, Rodrigo Álvaro Brandão Lopes-Martins ^e, Jan Magnus Bjordal ^{a,b}.

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Objective: To investigate the effect of therapeutic infrared class 3B laser irradiation on skin temperature in healthy participants of differing skin color, age and gender.

Background: Little is known about potential thermal effects of Low Level Laser Therapy (LLLT) irradiation on human skin.

Method: Skin temperature was measured in 40 healthy volunteers with a thermographic camera at a laser irradiated and a control (non-irradiated) area on the skin. Six irradiation doses (2-12 J) were delivered from a 200 mW, 810 nm laser and a 60 mW, 904 nm laser, respectively.

Results: Thermal effects of therapeutic LLLT using doses recommended in the World Association for Laser Therapy (WALT) guidelines, were insignificant and below 1.5°C in white and colored skin. When higher irradiation doses were used, the 60 mW, 904 nm laser, produced significantly ($p < 0.01$) higher temperatures in dark skin (5.7, SD $\pm 1.8^\circ\text{C}$ at 12 J) than in white skin, although no participants requested termination of LLLT. However, irradiation with 200 mW, 810 nm laser induced 3 to 6 times more heat in dark skin than in the other skin color groups. Eight of 13 participants with dark skin asked for LLLT to be stopped because of uncomfortable heating, with a maximal increase in skin temperature of 22.3°C.

Conclusion: Thermal effects of LLLT at doses recommended by WALT guidelines for musculoskeletal and inflammatory conditions, are negligible ($< 1.5^\circ\text{C}$) in white skin and colored skin. However, higher LLLT doses delivered with a strong 3B laser (200mW) are capable of increasing skin temperature significantly and these photothermal effects may exceed the thermal pain threshold for humans with dark skin color.

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Title: Effects of low level laser therapy in TGF- β expression in skeletal muscle during repair process.

Author(s): Raquel Agnelli Mesquita Ferrari, Kristianne Porta Santos Fernandes, Jose Antônio da Silva Junior, Vanessa Christina Santos Pavesi, Juliana Baptista, Manoela Domingues Martins, Sandra Kalil Bussadori.

Background and objective: Low-level laser therapy (LLLT) has been the subject of researches to understand the mechanisms by which the laser acts stimulating skeletal muscle regeneration. This process influences cellular proliferation and migration. Growth factors are directly involved in these mechanisms. The aim of the present study was to determine the effect of GaAlAs Low-level laser therapy (LLLT) on TGF- β expression in rats tibialis anterior (TA) muscle following cryolesion.

Methods: Adult male Wistar rats (n=45) were used and randomly divided into three groups: control (n=5); non-treated cryolesioned group (n=20) and LLLT cryolesioned group (n=20). The cryolesioned groups were analyzed at 1, 7, 14 and 21 days after the injury procedure. Laser irradiation was performed three times a week on the injured region using the GaAlAs laser (660nm; beam spot of 0.04 cm², output power of 20mW, power density of 500mW/cm², energy density of 5 J/cm², for 10 seconds). The muscles were removed and total RNA was isolated using TRIzol reagent and cDNA synthesis and real time polymerase chain reaction (PCR) were performed using primers of TGF- β as well as GAPDH to normalize the data

Results: It was demonstrated that LLLT promotes a decrease in TGF- β expression in skeletal muscle only after 7 days following cryolesion when compared with control and cryolesioned animals without treatment. Furthermore, LLLT did not modify TGF- β expression in other periods evaluated

Conclusion: The LLLT was able to induce a decrease in TGF- β expression after 7 days following cryolesion in tibial anterior muscle.

Title: INTERFERENTIAL LASER THERAPY IN THE TREATMENT OF SHOULDER PAIN AND DISABILITY

Author(s): MONTES-MOLINA, R¹; MARTINEZ-RUIZ, F², PRIETO-BAQUERO, A¹; ROMOJARO-RODRÍGUEZ, AB¹; MARTINEZ-RODRIGUEZ, ME³ and GALLEGU-MENDEZ, V¹ ¹Unit of Physiotherapy. Hospital Ramón y Cajal. Madrid. ² Unit of Biomaterials. Hospital Ramón y Cajal. Madrid. ³ Department of Physical Medicine and Rehabilitation. Hospital Ramon y Cajal. Madrid.

Background: The interferential laser therapy has shown to be safe and effective in treating knee pain. To compare the effectiveness of an interferential pattern in the reduction of pain and joint disability associated with shoulder musculoskeletal disorders.

Method: Blind and randomised controlled clinical trial. A total of 200 patients with shoulder pain were randomly assigned into two groups. Group 1 (n=100) received interferential laser therapy. Group 2 (n=100) received conventional laser therapy. The laser used was AlGaAs (wavelength, 810 nm; maximum output power, 100 mW in continuous emission mode). Ten sessions were applied on 5 shoulder points (7 J/point) per session. Main outcome measures were shoulder pain and disability that were measured before and after treatments. Pain was assessed using a visual analogue scale (VAS) at rest, at night, in shoulder flexion, extension, abduction, external and internal rotation. Disability was measured by the shoulder pain and disability index (SPADI).

Results: Main disorders treated were tendinitis (51.5%), calcified tendinitis (16.0 %) and rotator cuff tears (13.6 %). There was no difference in the reduction of VAS and SPADI (unpaired t-test, p<0.05) between both groups. Nevertheless, both treatments obtained statistically significant reductions in VAS and SPADI scores (paired t-test p< .0001).

Conclusion: Interferential laser therapy was as effective as conventional laser therapy –both being applied in skin contact technique- in the reduction of shoulder pain and disability.

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Title: Expression of Stem Cell Markers in Human Adipose Derived Stem Cells After Long Term Exposure to Laser Irradiation

Author(s): T.J. Moore¹ and H. Abrahamse². ¹School of Anatomical Sciences, Faculty of Health Sciences, University of the Witwatersrand, Medical School, 7 York Road. Parktown, South Africa, 2193. ²Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa, 2028.

Background and Objective: Stem cells play an important role in replenishment and replacement of differentiated cells in tissues. Laser irradiation has been shown to be effective in stimulating wound healing, however the effects of long term exposure of stem cells to laser irradiation, to our knowledge, has not been investigated. The current study aims to monitor the expression of known stem cell markers in cultured human adipose derived stem cells exposed to daily laser irradiation over the course of 5 days.

Methods: Cultures of primary isolates of hADSC's will be exposed daily to laser irradiation at 680nm at a fluence of 5J/cm². The daily and cumulative effect of the irradiation on the cells will be monitored by preparing the cells for RT-PCR 24 hours after the final exposure every day over 5 days to assess the expression of stem cells markers including, Thy-1, Beta1 integrin, Oct3/4 and c-kit. The expression will be confirmed by Western blot analysis. In addition, cellular viability and morphology will also be monitored.

Results: The level of expression of the different stem cell markers will be monitored, depending on the effect of the laser irradiation on the cells.

Conclusion: This study will further the understanding of the effect and role that laser irradiation has on stem cells.

Title: The effect of phototherapy with low intensity laser on inflammation and healing of cryogenic lesions

Author(s): Moreira M.S.; Ferreira L.S.; Ribeiro L.A.; Meneguzzo D.T.; Velasco I.T.; Marques M.M.

Background and objective: The objective of this study was to evaluate the effect of phototherapy with low intensity laser (PLIL) on the inflammation and healing processes following cryogenic injury.

Methods: The PLIL was applied or not (controls) immediately after cryogenic injury performed in the brain of 51 male Wistar rats for local and systemic immunomodulation analyses, and of 40 rats for wound healing analysis. The animals were irradiated twice (3 h interval), with continuous diode laser (GaAlAs, 780 nm, or InGaAlP, 660 nm) in 2 points and contact mode, 40 mW, spot size 0.04 cm², 3 J/cm² and 5 J/cm² (3 s and 5 s, respectively). The productions of IL-1b, IL-6, IL-10, and TNF-a were analyzed by the ELISA test in brain and blood samples, 6 h and 24 h after the first irradiation. The infiltration of inflammatory cells and the size of the lesion were assessed 6 h, 1, 7 and 14 days using immunohistochemistry. Data were analyzed by ANOVA followed by Tukey's test ($\alpha=5\%$).

Results: Cryogenic trauma promoted necrosis, edema, hemorrhage, and inflammatory process. The PLIL changed the TNF- α , IL-1 β and IL-6 levels in the brain and in blood. The initial lesion size and infiltration of inflammatory cells were diminished by LPT.

Conclusion: Under the conditions of this study, it is possible to conclude that after cryogenic injury the PLIL can affect local and systemic levels of TNF- α , IL-1 β and IL-6 LPT also influences positively in the determination of the initial damage extension and infiltration of inflammatory cells.

Title: Laser therapy enhances attachment and proliferation of human gingival fibroblast cultured on titanium implant material under hyperglycemic circumstances

Author(s): Maawan Khadra DDS, PhD & Hans R. Haanæs DDS, PhD. Department of Oral Surgery and Oral Medicine, Faculty of Dentistry, University of Oslo, P.O.Box 1109 Blindern, N-0317 Oslo, Norway.

Background and objective:

Implant therapy is highly predictable and successful. However, certain risk factors such as diabetes can predispose individuals to lower rates of success.

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The aim of this *in vitro* study was to investigate the effect of low-level laser therapy (LLLT) on attachment and proliferation of human gingival fibroblasts (HGF) cultured on titanium implant material under hyperglycemic circumstances.

Methods: HGF, cultured in medium supplemented by 30 g/L glucose, were exposed to gallium–aluminum–arsenide diode laser at dosages of 1.5 or 3 J/cm² and then seeded onto titanium discs. Non-irradiated cultures served as controls. After 1, 3 and 24 h, cells were stained and the attached cells were counted under a light microscope. In order to investigate the effect of LLLT on cell proliferation after 48, 72 and 96 h, cells were cultured on titanium specimens for 24 h and then exposed to laser irradiation for three consecutive days.

Results: LLLT significantly enhanced cellular attachment ($P < 0.05$). Greater cell proliferation in the irradiated groups was observed first after 96 h.

Conclusion: These results showed that in response to LLLT, HGF cultured on titanium implant material under hyperglycemic circumstances had a tendency towards increased cellular attachment and proliferation, indicating that *in vitro* LLLT can modulate the activity of cells and tissues surrounding implant material. Further studies are needed to clarify whether these parameters would also be optimal under *in vivo* conditions.

Title: **Light emission diode in the tissue repair of the crush lesion calf muscle in rats.**

Authors: Michele A Nishioka, Carlos E Pinfieldi, Arayni Antunes, Bruno B Hatty, Fabio C de Amo, Rodrigo P Prado, Lydia M. Ferreira

Background and objective: The muscular injuries are the most common lesions in athletes' population by direct or indirect trauma. New therapies have been used with the aim to improve the muscular repair process and the light emission diode (LED) is a new modality to treat this affection.

Methods: Twenty animals were divided in four groups: Group without lesion (GWL), Group Sham (GS) that was underwent to crush lesion and sham irradiation, Group lesion + LED 850nm (G850) that was underwent the crush lesion and treated with LED 850nm and Group lesion + LED 630nm (G630) that was underwent the same lesion and treated with LED 630nm. The lesion was realized by direct trauma (crush lesion) with a weight of 200g that was released perpendicularly over the calf muscle. The treatment with LED was realized after lesion and during five consecutive days. The delivery time of exposure was 34 seconds with dose 10J/cm². After all procedure was realized the blood vessels morphometric. The statistic analysis was realized by T Student Test and the statistical significance for all values was set at $p < 0.05$.

Results: When compared the GWL and GS was not possible to found significance results ($p > 0,408$). However, the comparison between G850 and G630, the G850 showed better results than G630 ($p < 0.007$). All LED groups were better than GWL and GS with $p < 0.001$.

Conclusion: The LED therapy was efficient in the muscle repair and show an improve of the blood vessels to both wavelength, but the 850nm was better than 630nm.

Title: **Anti-inflammatory effects of 635nm LED irradiation on MC3T3-E1 in high glucose**

Author(s): Okjoon Kim¹, Hyukil Kwon¹, Wonbong Lim¹, Jisun Kim¹, Inae Kim¹, Youngjong Ko¹, Sangwoo Kim¹, Misook Kim¹, SeoYune Kim¹, Xiaojie Li¹, Hongran Choi¹

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Background and objective: Patients with diabetes tend to have an increased incidence of bone resorption that may be related to the bacteria-induced inflammation. Previous studies have indicated that Lipopolysaccharide (LPS), a product from the cell wall of gram-negative bacteria in plaque, has been implicated in periodontitis, and cyclooxygenase-2 (COX-2) and prostaglandin E2 (PGE2) are one of the key-factors that stimulate the release of the receptor activator of nuclear factor kappaB ligand (RANKL), the main factor of osteoclastogenesis, from osteoblasts. The anti-inflammatory effects have been presented in clinical fields for specific wavelength irradiation. The present study was

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undertaken to determine the effect of 635 nm light-emitting-diode (LED) irradiation on the expression of COX-2, PGE2 in the high concentration of glucose.

Methods: mouse MC3T3-E1 osteoblasts were cultured with high concentration of glucose, and treated LPS to cause inflammation. After irradiation of 635 nm LED, the expression of COX-2 was determined using western blot, and the production of PGE2 was determined using enzyme-linked immunosorbent assay (ELISA).

Results: 635 nm LED irradiation could induce decreased COX-2 and PGE2 in high glucose.

Conclusion: these studies provide insight into a potential mechanism by which 635 nm LED irradiation can inhibit inflammatory factors in high concentration of glucose.

Title: Effect of Low Level Laser Therapy (830 nm) With Different Therapy Regimes on the Process of Tissue Repair in Partial Lesion Calcaneous Tendon

Authors: Carlos E Pinfieldi , Flavia S Oliveira, Nivaldo A Parizoto, Richard E Liebano, Paulo Bossini, Lydia M Ferreira

Background and objective: Calcaneous tendon is one of the most damaged tendons, and its healing may last from weeks to months to be completed. In the search after speeding tendon repair, low intensity laser therapy has shown favorable effect. To assess the effect of low intensity laser therapy on the process of tissue repair in calcaneous tendon after undergoing a partial lesion

Methods: Sixty male rats were used randomly and were assigned to five groups containing 12 animals each one; 42 out of 60 underwent lesion caused by dropping a 186 g weight over their Achilles tendon from a 20 cm height. In Group 1 (standard control), animals did not suffer the lesion nor underwent laser therapy; in Group 2 (control), animals suffered the lesion but did not undergo laser therapy; in Groups 3, 4, and 5, animals suffered lesion and underwent laser therapy for 3, 5, and 7 days, respectively. Animals which suffered lesion were sacrificed on the 8th day after the lesion and assessed by polarization microscopy to analyze the degree of collagen fibers organization

Results: Both experimental and standard control Groups presented significant values when compared with the control Groups, and there was no significant difference when Groups 1 and 4 were compared; the same occurred between Groups 3 and 5.

Conclusion: Low intensity laser therapy was effective in the improvement of collagen fibers organization of the calcaneous tendon after undergoing a partial lesion.

Title: ANTIALGIC EFFECT OF LOW INTENSITY LASER IN THE TREATMENT OF CERVICOGENIC HEADACHES

Author(s): Pizzo, R. C. A.; Dach, F.; Bordini, C. A.; Lizarelli, R. F. Z*; Speciali, J. G.

Department of Neurociences, Division of Neurology, School of Medicine, Clinical Hospital of Ribeirão Preto – University of São Paulo. *Physics Institut of São Carlos, Optics Group, Biophotonics Laboratory – University of São Paulo, São Carlos, SP – Brazil.

Background and objective: Cervicogenic headache(CH) is any type of headache originating in low neck structures. It is characterized by nuchal and/or frontotemporal pain triggered by disturbances in the neck region at the C1, C2 or C3 level. Blockade of the major and minor occipital nerves is performed for therapeutic and diagnostic purposes. To determine the effect of low intensity laser (GaAlAs) applied to the region of the major and minor occipital nerves and/or of the C2 root on the symptomatic side for the treatment of cervicogenic headaches, as an alternative procedure to conventional blockade.

Methods: Twenty patients from the Headache Outpatient Clinic of the University Hospital of FMRP/USP were submitted to the procedure. Each patient was evaluated by a neurologist, who made the diagnosis of CH (SJAASTAD,1990). The patients were submitted to laser applications (780nm,70mW,continuous) on the symptomatic side at 8 trigger-points located by palpation in the region of the major and minor occipital nerves, with one D=157,5J/cm² per point being applied once a week for 4 weeks. The patients filled out a pain diary (scores of 0 to 10) and were evaluated on four

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occasions: A0(before the 1st application),A1(immediately after the last application),A2 and A3(30 and 60 days after the last application).

Results: The weekly mean pain score was calculated (A0=9.635;A1=2.638;A2=2.788;A3=2.937) and analysis of the results identified statistically significant differences ($p=0.001$, paired t-test) between A0 and A3 regarding pain intensity.

Conclusion: On the basis of the above data, we may suggest that low intensity laser promoted a reduction of the intensity and frequency of symptoms.

Title: LEDTHERAPY FOR TMJ AND CERVICOGENIC HEADACHE TREATMENT

Author(s): R. C. A. Pizzo 2; J. G. Speciali 2; F. Dach 2; V. H. Panhoca 2; V. S. Bagnato 3; R. F. Z. Lizarelli 1. 1. NILO (Núcleo Integrado de Laser em Odontologia), Ribeirão Preto, SP . 2. Department of Neurociences, Division of Neurology, School of Medicine, Clinical Hospital of Ribeirão Preto – University of São Paulo, Ribeirão Preto, SP – Brazil. 3. Physics Institut of São Carlos, Optics Group, Biophotonics Laboratory – University of São Paulo.

Background and objective: The low intensity laser therapy has been widely applied in pain relief or analgesia mechanism considering several clinical situations. With the advent of new LED-based (light emitting diode) light sources, the need of further clinical experiments aiming to compare the effectiveness among them is paramount.

Methods: Proposes an evaluation of antialgic effect to TMJs internal disorders and cervicogenic headache(CH) using two different sources of LEDs, one emitting at the spectral band of red(630 +/- 5 nm) and the other one at infrared band(880 +/- 5 nm), comparatively to a control group(780nm lasertherapy using 105,7 J/cm²). Considering TMJ, Mandibular oral aperture and pain sintomatology are being considered using appropriate equipment developed to do it. Power out put is 150mW. Fluency chosen is 24 J/cm² for each point of application. Five points are irradiated: three around TMJ, one at the anterior fibers of temporal muscle and other at the center of masseter muscle. Eight sessions of applications area done and follow up care of 7, 30 and 60 days, after the last session. Thirty patients are into treatment. Their selection was randomly for groups of treatment, resulting in 10 patients for each group (infrared LED, red LED and Placebo).

Results: Seventy per cent of all patients under both LED treatment, red and infrared, became better, considering pain sintomatology and oral aperture, showing similar results in comparison with control group. Considering CH, some clinical cases, using standardized doses and application points, are under evaluation and they are presenting improvement to pain relief.

Conclusion: Ledtherapy can be indicated to treat TMJs disorders and Cervicogenic Headache as lasertherapy, under the same parameters of wavelength and fluency.

Title: Comparative Effects of Low-intensity Pulses Ultrasound and Low Level Laser Therapy on Injured Skeletal Muscle

Author(s): Daniel Araki Ribeiro¹, Renata Luri Toma¹, Suellen Maurin Feitosa¹, Kelly Fernandes¹, Paulo Sergio Bossini², Poliani de Oliveira², Nivaldo Parizotto², Ana Claudia Muniz Renno¹

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Background and objective: The main purpose of the present study was to compare the effects of low-intensity pulsed ultrasound (US) and low-level laser therapy (LLLT) on injured skeletal muscle after cryolesion by means of histopathological analysis and immunohistochemistry for COX-2.

Methods: A total of thirty five male Wistar rats were randomly distributed into 4 groups: intact control group –uninjured and untreated animals; animals with muscle injury without any treatment; LLLT treated group –muscle injured treated with 830 nm LLLT; and US-treated group –muscle injured animals treated with US. Treatments started 24 hours post-surgery and were performed during six sessions.

Results: Animals exposed to LLLT presented minor degenerative changes of muscle tissue. In the same way, exposure to US was able to reduce tissue injuries induced by cryolesion-induced tissue

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injuries, but less intensely than LLLT. A large number of COX-2 positive cells were found in rats exposed to cryolesion only, whereas COX-2 immunoexpression was less in both LLLT- and US-treated groups.

Conclusion: In summary, this study reveals that both LLLT and US therapies have positive effects on muscle metabolism after an injury in rats. However, LLLT seems to produce a better response.

Title: Histological analysis of short-term effects of low-level laser irradiation in acute inflammation of Achilles tendon

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Background and Objectives: Tendinopathy is a common muscle-skeletal disorder, and different Therapeutic modalities have been used to treat such disease such as: eccentric exercises, NSAIDs, corticoid injection and others. However, NSAIDs and corticoid injection presents several side effects related to long-term administration. Low-level laser therapy (LLLT) is a novel treatment modality, and in the last years has shown positive effects in several inflammatory conditions with no side effects. In this study we investigated the effects of LLLT in acute inflammation of Achilles tendon in rats.

Methods: Inflammation of rat Achilles tendon was induced by collagenase injection (1 mg/ml) in 20 Wistar rats. Animals were randomized in 4 experimental groups: tendonitis (Td), Td + diclofenac, Td + dexamethasone and Td + LLLT (3 J, 830 nm, 100 mW). A single treatment was performed immediately after stimulus.

Results: Twelve hours after collagenase injection, Td group showed an important inflammatory cells infiltration in peritendinous area (++++/++++), however in all treated groups we observed a reduction in cell infiltration in peritendinous area: diclofenac (+/++++), dexamethasone (+/++++) and LLLT (+/++++).

Conclusion: In spite of positive results observed in all treated groups, LLLT could be considered an effective therapeutic modality in treatment of Achilles tendinopathy, considering its non-invasive application and the absence of side effects. However, further studies are needed to investigate the long-term effects of LLLT in treatment of tendon inflammation.

Title: Fraxel re:fine Laser Resurfacing in the Treatment of Dilated Pores

Authors: Ji-Ho Ryou, MD, Dong-Hye Suh, M.D., Kye-Yong Song, M.D*. Department of Dermatology, Anacli Dermatologic Clinic, Department of Pathology, College of Medicine, Chung-Ang University, Seoul, Korea.

Background and objective: Dilated pores are a structures at the facial skin surface especially nose, anterior side of the cheek, corresponding to openings of the pilosebaceous follicles. They are physiologically present in all individuals, but their size can vary. Although multiple therapeutic modalities have previously been tried and touted as being successful, long-termed efficacious treatment options have been few. Fractional laser technology has recently become popular for the purpose of rejuvenation and scars. Recently, an erbium-doped fiber laser, emitting light at 1,410 nm(Fraxel re:fine), has been shown to be effective in the treatment of photodamaged skin, acne scars, post-surgical scarring, pigmented lesions, striae distensae, as well as melasma. We attempt to evaluate the clinical and ultrastructural changes fractional laser treatment of dilated pore.

Methods: Our case series was comprised of 15 patients(1 men, 14 women; aged 25-48;Fitzpatrick skin type III-IV) with enlarged facial proes in symmetry. Each subject received a series of 3 treatments

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with the Fraxel re:fine laser at settings of 20mJ and 20% coverage, each with an interval of 3 weeks. The patients were photographically assessed the degree of reduction in pore size based on a quartile grading scale at baseline, before each treatment session, and 1 months after the final treatment. Also histologically assessed at baseline and 2 months after the final treatment.

Results: Two of fifteen patients had minimal to no improvement(13.3%), three moderate improvement(20.0%), and ten marked improvement(66.6%). Histological findings at 1 months after the final treatment, the sebaceous gland was decreased and the collagen fibers increased in dermis.

Conclusion: In conclusion, we believe the 1410 fractional laser(Fraxel re:fine) is an effective and safe method for improving dilated pore, even in Asian skin.

Title: Phototoxic Effect Of Zinc Sulphophthalocyanine Photosensitizer On Human Colon (Dld-1) And Lung (A549) Carcinoma Cells (*In Vitro*)

Author(s): P.R. Sekhejane, S.L. Manoto, N.N. Houreld and H. Abrahamse.

Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa, 2028.

Background and Objective: Cancer is amongst the most challenging diseases regarding treatment. According to World Health Organization (WHO) cancer is the most devastating disease worldwide and 83.2 million people will die by 2015. Photodynamic therapy (PDT) is a minimally invasive therapeutic modality for different cancers, it comprises of three components *viz.* light (usually in the red or near-infrared spectrum), photosensitizer (PS; light absorbing compound) and molecular oxygen to induce cell death. The PS localizes in tumour cells which are then irradiated with an appropriate wavelength, resulting in tumour destruction. The objective of this study was to determine the phototoxic pattern of Zinc phthalocyanine (ZnPc) PS alone in DLD-1 and A549 cells and extent of PDT using different concentrations of PS.

Methods: Cells were divided into PS only (control) and PDT (light and PS). DLD-1 and A549 cells were grown in DMEM/F12 and RPMI 1640 media (respectively) and cultivated for 4 h. ZnPc at different concentrations [0, 5, 10, 20 and 40 μ M] was added thereafter and incubated for 24 h. PDT cells were irradiated at a wavelength of 680 nm with 5 J/cm² and incubated for 24 h. Cellular morphology was determined by light microscope and biochemical changes by Trypan Blue, ATP and LDH.

Results: Morphologically, cells looked bizarre and detached after PDT, Trypan Blue and ATP decreased in a dose-dependent manner in PDT cells, while LDH decreased with an increase in PS except in 40 μ M PDT cells.

Conclusion: In the absence of light, ZnPc has insignificant toxicity, however, after irradiation a concentration of 20 μ M ZnPc yields optimum cell death induction.

Title: Management of Trigeminal Neuralgia With Laser Acupuncture : A Case Report

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Background and objective: Trigeminal neuralgia is characterised with paroxysmal, severe and sharp pain that is localized in the distribution of the branches of N. Trigemini which alters patients daily activity. However, surgical applications to treat trigeminal neuralgia such as glycerole injection, neurectomies etc. cause persistent neural damage, laser acupuncture (LA) as a non-invasive procedure provides treatment, avoiding neural damage and long time drug usage.

Methods: 42 years old male patient with trigeminal neuralgia consulted us. He has been using carbamazepine (Tegretol 4 × 400 mg) for ten years. After the examination of the patient, it has been discovered that N. Alveolaris Inferior and N. Mentalis were involved. The patient was managed with LA with 650 nm, 50 mW for 20 seconds on related acupuncture points for 15 sessions, after 3 weeks holiday 10 more sessions has been applied.

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Results: During the therapy, dosage of carbamazepine per a day was decreased and quitted according to the necessity of the patient. At the end of the therapy, pain was passed off. In one year follow-up, with no carbamazepine usage, no recurrence reported.

Conclusion: Management of trigeminal neuralgia with laser acupuncture (LA) is not only an alternative therapy to surgery and medical therapy also provides comfort of the patient by preserving sensory functions of face.

Title: Effects of low-fluence PDT on human endothelial cells and macrophages

Author(s): Udartseva Olga Olegovna, Andreeva Elena Romualdovna, Buravkova Ludmila Borisovna
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Background and objective: Recently we have shown that vascular cells possess different susceptibility to photodynamic treatment (PDT). However, to slow down atherosclerotic process, it's not necessary to kill cells as in tumor, but it will be sufficient to decrease their functional activity. Thus, endothelial dysfunction is the initial step of atherosclerotic changes in artery wall, while Mph are considered to be key cells in vascular pathology because of their lipid accumulation. In present study we screened effects of low-fluence PDT on Mph and HUVEC.

Methods: Human Mph and ECs (HUVEC) were obtained and cultured as described elsewhere. 24 h before PDT 10 µg/ml Photosens[®](PS) was added to culture medium. Then cells were washed and illuminated with 675-nm light (0,25–0,5 J/cm²). Cellular viability was measured with MTT-test. Mph phagocytosis was studied using fluorescent latex beads 24 hours after PDT. Expression of HUVEC adhesion molecules were detected by flow cytometry. Mitochondrial and lysosomal activity was studied by Mitotracker and LysoTracker respectively 2 hours after PDT. Mph adhesion to HUVEC was measured according standard protocol.

Results: Neither PDT components separately nor low-fluence PS-PDT (0,25-0,5 J/cm²) did not affect cell viability. Illumination of PS-loaded Mph with 0,25 and 0,5 J/cm² fluence decreased phagocytic activity in 1,5 and 2,4 times respectively. Low-fluence PS-PDT didn't effect expression of HUVEC adhesion molecules. However, PDT with 0,25 J/cm² dose decrease Mph spreading and adhesion to HUVEC.

Conclusion: Low-fluence PDT can effectively decrease Mph phagocytic activity and their adhesion to HUVEC without reduction of vascular cell viability.