

27-30 SEP 2012 • GOLD COAST

# WORLD ASSOCIATION FOR LASER THERAPY CONFERENCE



# WALT

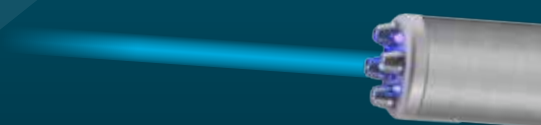
World Association for Laser Therapy

**amla** AUSTRALIAN MEDICAL  
LASER ASSOCIATION



# HANDBOOK

[WWW.WALT2012.COM](http://WWW.WALT2012.COM)





## Welcome message from Mayor Tom Tate

As Mayor of the Gold Coast it is my pleasure to welcome you to our city for The 9th World Association for Laser Therapy Congress.

Australia's sixth largest city, the Gold Coast is a unique place to visit; offering a spectacular coastline and iconic rainforests alongside world-class entertainment and a dynamic business environment.

As well as being a great place to visit, the Gold Coast is the perfect location for innovation and investment. We are a progressive city that values entrepreneurship and new ideas. With our population expected to nearly double over the next twenty years, the Gold Coast market is the fastest growing in Australia.

Gold Coast City has a wealth of health and medical infrastructure and expertise. Our world-class research, training and education facilities support continued and innovative growth of the industry.

Six hospitals – both public and private – several day procedure centres and a large number of specialist clinics, provide specialist medical services to local and global markets.

We welcome millions of visitors each year to our one-of-a-kind city. I am confident they experience a warm, engaging community in a location that shines all year round.

On behalf of all Gold Coasters, I wish you a safe and enjoyable visit.

Yours sincerely



**Tom Tate**  
Mayor of the Gold Coast

## G'day and welcome to WALT2012

Dear friends and colleagues,

We are very excited by the opportunity to welcome delegates, exhibitors, speakers and sponsors to WALT2012 at the QT Hotel in the heart of Australia's magnificent Gold Coast. It seems like only yesterday since the last World Association for Laser Therapy (WALT) Congress in Norway where the Australian Medical Laser Association (AMLA) presented a bid to host the WALT2012 Congress in Australia. As WALT2012 gets underway, we are pleased that all of the preparation and planning for the Congress has now been realised and we hope that the trust shown by the Executive Committee of WALT in AMLA, to deliver WALT2012, is justified.

The Congress scientific program should provide something for everyone as it represents the broad conference theme: The spectrum of laser – translating basic research to clinical outcomes. Over 120 abstracts were submitted for podium and poster presentations, and we thank all authors for their interest in contributing to the success of the WALT2012 program. Our thanks are extended to Prof David Baxter and his panel of international abstract reviewers for their commitment to ensuring a high quality scientific program. We are delighted also, that almost all of the invited speakers asked to present at WALT2012 were able to take part. Our belief is that each will provide depth and richness to the Congress program by their combined expertise.

As Co-Chairs, we thank those who have contributed to what we believe will be a very successful conference. We specifically acknowledge the exhibitors and sponsors in particular **MyHealthyGP.com** as Congress Platinum Sponsor, and William Green as primary sponsor of the dental stream. As delegates, please make sure you visit the trade displays and talk to the exhibitors because without them, conferences such as WALT2012 are difficult to deliver. We also wish to thank the members of the Organising and Scientific Committees; Jan Marquardt and Cathryn Gertzos (of AST Management); and the conference venue management amongst others.

Some of you may have attended the pre-Congress workshops, so we hope you've been able to learn something about laser basics that can be built upon during WALT2012. One of the pre-Congress activities was the World Federation for Laser Dentistry (WFLD; Asia Pacific Division) laser course. We welcome WFLD involvement in WALT2012, and particularly the Chair of the dental stream, Dr Ambrose Chan. We also wish to thank Penny Smalley for agreeing to conduct a pre-Congress Laser Safety course; and Ann Liebert, Phil Gabel and Prof David Baxter for their contribution to the AMLA Laser Fundamentals course.

Lastly and most importantly, we thank you – the delegate. To international delegates (and families): Some say that Australia is a long way away. We say that it's worth it. By the end of your time in Australia, we hope that you'll agree. To our Australian delegates, we trust that you'll find WALT2012 interesting and thought-provoking enough that you'll consider joining AMLA. We would welcome your application for membership (there's a membership application form in your conference satchel!).

We believe that you will find the social program with its Australian overture both fun and interesting. To obtain the most from the programming, we urge you to talk with someone new each day, catch up with old friends, start new networks, learn as much as you can, see the sites and enjoy the hospitality of locals.

As the Co-Chairs of WALT2012, if we can assist you please let us know, or please see the conference secretariat at the Registration Desk. In the meantime, we wish you all a happy and safe time on the Gold Coast and hope that you enjoy and gain much from WALT2012.



**A/Prof Liisa Laakso**  
Co-Chair  
l.laakso@griffith.edu.au



**Dr Roberta Chow**  
Co-Chair  
robertachow@iinet.net.au



## Welcome from the WALT President

What a privilege and honour for me to welcome you to the 9th World Association for Laser Therapy congress in Australia!

WALT was formed in 1994 in Barcelona, Spain, at the joint congresses of the International Laser Therapy Association and the international Society for Laser Applications in Medicine 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. WALT forms a platform for different disciplines of science to interact but also forms a bridge between mature and young scientists. The last two decades have seen an unprecedented growth and rapid development in the field of laser technology and the application thereof in the fields of science and technology with special emphasis in the area of medicine. The aim of WALT congresses remains the same: to establish an outstanding interaction between the delegates in a unique location and an unforgettable atmosphere where friendship, intelligence and scientific know-how are blended. Let me also use this opportunity to thank and congratulate the WALT2012 organising committee for their uncompromising dedication and hard work to arrange yet another successful forum for researchers and scientists to present their work to the international community.

On behalf of the Executive Committee of WALT, I welcome all delegates to a wonderful congress filled with exciting scientific discussion and learning opportunities in the field of laser therapy.

**Heidi Abrahamse**  
President, World Association for Laser Therapy (WALT)

## Welcome from the Dental Stream Chair

On behalf of the Local Organizing Committee of the 9th World Association for Laser Therapy (WALT) congress, it is my honour and privilege as the Chairman of the dental stream, to welcome the distinguished dental speakers, sponsors and delegates to this outstanding meeting.

Advances in laser technology are changing the way that patients experience treatments as well as the way that diseases are being diagnosed and cured. Laser technology provides more efficient alternatives, comfortable experiences and predictable outcomes for patients. This is made possible by the continuous exchange, advancement and dissemination of scientific research and development in the fields of laser medicine and dentistry.

The WALT2012 congress is a unique opportunity to gather medical and dental researchers, clinicians, academicians and industries, from around the world, to present the latest technologies, scientific results and clinical advances in the field of laser/phototherapy. Importantly, the scientific and clinical evidence that will evolve from this meeting will strengthen the understanding towards benefits of the synergistic use of high and low intensity lasers, and how to integrate such technology, in dental practice.

Another important aspect of such an event is the chance to bring diversity into unity; for the exchange of ideas and methodologies in the field of laser medicine and dentistry; making new acquaintances and personal friendships; facilitating future collaborations among laser organizations, associations and industries; and last but not least, visiting our beautiful country of Australia.

Together, we invest in education and the technology of tomorrow to ensure a brighter future for professions and generations to come. May I wish you have a most enjoyable meeting full of rewarding experiences.

**Ambrose Chan**  
Chair, Dental Stream  
9th World Association for Laser Therapy Congress 2012

# State-of-the-art Diode Lasers

German made Dental Lasers



## elexxion claros **pico**

Fastest pulsing Diode Laser  
in the world

- Portable with 590g only
- Patented Digital Pulse Laser at 20,000Hz/s
- Pulse duration of 26µs (micro second)
- Almost no tissue carbonisation
- Fully autoclavable tips

## elexxion claros **nano**

Most powerful table top  
Diode Laser in the world

- Fully customisable setting
- Fully touch screen display
- 15w power
- Patented Digital Pulse Laser at 20,000Hz/s
- Pulse duration of 16µs (micro second)
- Fully autoclavable tips







## General Information

The following information is offered to make your attendance at The 9th World Association for Laser Therapy Congress as pleasant as possible. If you require help, please visit the Congress secretariat at the registration desk and we will do everything to assist you with your enquiry.

### Registration and Information Desk

The registration desk will be located at the entrance of the function area at the QT Surfers Paradise and will be open as follows:

Thursday 27th September .....5:00pm to 7:00pm  
Friday 28th September .....7:30am to 4:30pm  
Saturday 29th September .....8:00am to 4:30pm  
Sunday 30th September .....8:00am to 12:00pm

Upon arrival, please ensure you collect your Congress satchel and name badge at the registration desk. The staff will be happy to assist you in any way they can.

### Accommodation

Accommodation accounts must be settled with the hotel on check out. The committee and or the secretariat are not responsible in any way for outstanding accommodation accounts.

### Congress Entry

Each Congress delegate will be issued with a Name Badge on registering. The Name Badge must be worn at all times as it is your official pass to all sessions, the exhibition, lunch, morning tea, afternoon tea and social functions.

### Mobile Phones

Please ensure all mobile phones are turned off during all conference sessions.

### Telephone Directory

Registration Desk .....0435 899 307  
AST Management Pty Ltd .....(07) 5502 2068  
QT Gold Coast Hotel .....(07) 5584 1200  
Brisbane Airport .....(07) 3406 3000  
Gold Coast Airport .....(07) 5589 1100  
Virgin Australia ..... 136 789  
Jetstar ..... 131 538  
Qantas ..... 131 313  
Surfside Buslines ..... 131 230  
Gold Coast Cabs ..... 131 008

## Destination

The Gold Coast is Australia's sixth biggest city and the second biggest in Queensland. It has a sophisticated sense of style and is a true 'surfing' paradise with stunning beaches, exciting theme parks, and sun-kissed locals.

Just a short drive inland is the Gold Coast hinterland with quaint mountain villages and natural escapes in the World Heritage listed Central Eastern Rainforest Reserves.

The Gold Coast offers a wide array of accommodation including a great selection of beachfront hotels, holiday apartments and world class resorts, amazing shopping and award-winning dining choices.

Experience the contagious excitement, glorious weather and natural beauty of the Gold Coast.



## Host Venue – QT Gold Coast Hotel

Nostalgic surfer chic meets Miami catwalk cool in Australia's newest and most exciting hotel.

Welcome to QT Gold Coast. Setting a new standard of designer surfers paradise accommodation, the QT Gold Coast hotel is deliberately intended to inspire conversation and arrest the senses. Guests to our Gold Coast hotel can indulge in the vibrant beachside location and the unique Gold Coast spirit.

For guests and locals alike, QT Gold Coast is an entertainment destination. The Baja California cool of Stingray Lounge has become the premier hangout of Gold Coast's 'it' crowd and the unique marketplace style dining at bazaar is reason enough for many guests to return.

A playground for those who love food, wine, music, design, fashion and art, at QT Gold Coast you will discover good times, great parties and 'non-stop' action.

The hotel has 297 recently transformed guest rooms that have sleek designer bathrooms, custom interior design features and a relaxed beachside feel. A mix of nostalgic surfer chic combined with Miami catwalk cool.



## Invited Speakers

Proudly sponsored by Your Healthy GP



### Professor Heidi Abrahamse

---

Professor. Heidi Abrahamse BSc (RAU), BSc Honours (Biochemistry and Psychology; US, UNISA), MSc (Medical Biochemistry; US), PhD (Molecular biology; Wits University), 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 a number of research-related university committees for both universities and science councils and regularly reviews grant applications and research papers for internationally accredited journals. She currently directs the Laser Research Centre in the Faculty of Health Sciences at the University of Johannesburg and was the recipient of the University of Johannesburg Vice-Chancellor's Distinguished Award for Outstanding Researcher of the Year, 2010. Her research areas of interest include phototherapy, laser-tissue interaction, signal-transduction in cancer, wound healing and stem cell differentiation. She is currently the President of the World Association of Laser Therapy (WALT).



### Professor Juanita Anders

---

Juanita J. Anders is a Professor of Anatomy, Physiology and Genetics and Professor of Neuroscience at Uniformed Services University of the Health Sciences. She received her Ph.D. in Anatomy from the University of Maryland Medical School and specializes in peripheral and central nervous system injury and repair mechanisms and light tissue interactions. She is recognized as an expert in light therapy and has been invited to speak and chair sessions at numerous international laser conferences. Dr. Anders serves on the Executive Councils and Scientific Advisory Boards of several laser societies. She is the past president of the North American Association of Laser Therapy, a founding member of the International Academy of Laser Medicine and Surgery, and currently is the Vice President and President Elect of the American Society of Lasers in Medicine and Surgery. She serves on the Editorial Boards of Photomedicine and Laser Surgery, Lasers in Surgery and Medicine, Lasers in Medical Science, Physiotherapy Practice and Research and has published over 50 peer reviewed articles.



### Professor David Baxter

---

G. David Baxter TD BSc(Hons) DPhil (Ulster) MBA (London) is Dean and Professor of the School of Physiotherapy at University of Otago, New Zealand, and a Visiting Professor at the Health & Rehabilitation Research Institute at the University of Ulster (UK). Professor Baxter received his Bachelor of Science (Honours) in Physical Therapy in 1987, and a Doctorate of Philosophy (DPhil) in 1991 at the University of Ulster, and a Masters of Business Administration in 2006 at University of London. His doctoral research focussed on the pain relieving effects of laser therapy, and he has been recognised as a Fellow of the Royal Academy of Medicine in Ireland, and of the International Academy of Lasers in Medicine and Surgery, and the American Society for Lasers in Medicine and Surgery; he is also an honorary life member of the Acupuncture Association of Chartered Physiotherapists.





## Professor Jan Bjordal

---

MENZIES  
FOUNDATION

Dr. Jan M. Bjordal is trained as a physical therapist, with a PhD from University of Bergen, Norway in 2003. His current affiliations are as Professor with University of Bergen. He has authored 57 scientific publications, and has made 21 international congress presentations, and is the author of the textbook “Clinical Electrotherapy” and several chapters in pain management textbooks.

He is on the editorial board of three scientific journals, and acting as referee for more than a dozen journals. Through his work with low level laser therapy (LLLT) he was acting advisor for the Norwegian Physical Therapy Association when LLLT approval was given approval by the Ministry of Health in Norway, and he led the expert group in the Norwegian Health Technology Assessment which concluded that low level laser therapy was effective in knee osteoarthritis.

Prof Bjordal is Scientific Secretary to WALT and responsible for WALT guidelines; President of the World Confederation for Physical Therapy International Society for Electro-Physical Agents in Physiotherapy (ISEAPT); and co-author of the Lancet systematic review and meta-analysis of the efficacy of LLLT in the management of neck pain.



## Professor Aldo Brugnera

---

- Emeritus Professor at the Camilo Castelo Branco University – Unicastelo
- Doctor in Dentistry – Federal University of Rio de Janeiro – UFRJ – Brazil
- Senior Lecturer at Master and PhD course at Unicastelo
- Senior Lecturer at Master course Oral Laser Application – Europe
- President of WFLD – World Federation of Lasers in Dentistry (2012-2014)
- Past President of WALT – World Association for Laser Therapy
- Senior Editor of the Journal Photomedicine and Laser Surgery – USA
- Author of 5 books in the area of Laser in Dentistry and author of various chapters in other publications



## Associate Professor Lee Collins

---

Assoc. Prof. Lee Collins AM BSc(Hons) MSc FACPSEM MARPS is Director of the Medical Physics Department at Westmead Hospital, Sydney, Australia. His main interests are in ionising and non-ionising radiation safety and radiology physics. He is Chairman of the Standards Australia medical laser safety committee, and a member of the International Electrotechnical Commission committee TC76 (laser safety). He was made a Member of the Order of Australia in 2003, and is an Adjunct Associate Professor in the School of Medical Radiation Science at the University of Sydney, and Conjoint Associate Professor in the Schools of Medicine, University of Western Sydney and Notre Dame Australia University.



## Dr How Kim Chuan

---

Dr How graduated from Singapore in 1991. He went on to specialize in Orthodontics in London in 1993. He is also well qualified in Oral Surgery. Dr How possesses a number of post graduate qualifications in Orthodontics, Oral Surgery, Implantology as well as Laser Dentistry. He is now a Fellow as well as a Diplomate for the International Congress of Oral Implantologist (ICOI); and a Fellow of the Royal College of Surgeons for Orthodontics as well as Oral Surgery.



Dr How is also a Fellow of the Academy of Medicine of Malaysia College of Dental Specialists. He is the Key Opinion Leader for Straumann in Malaysia as well as the Course Director for Osstem implant system in Malaysia. Dato' Dr How is also the Founding member as well as the Vice-President for the Malaysian ITI Society. Dr How is a Fellow of the World Clinical Laser Institute as well as a Certified Laser Trainer for Biolase and is the Malaysian Country Representative for World Federation of Laser Dentistry.



### **Prof Chukuka Enwemeka**

---

Dr. Chukuka S. Enwemeka is Distinguished Professor and Dean of the College of Health Sciences, University of Wisconsin, Milwaukee. He received his B.S. and M.S. in Physical Therapy from the University of Ibadan, Ibadan, Nigeria and the University of Southern California, Los Angeles, Calif., respectively. He earned his Ph.D. in Pathokinesiology from New York University (NYU), and did his post-doctoral research training at NYU's Rusk Institute of Rehabilitation Medicine.

As a distinguished researcher, Dr. Enwemeka has authored more than 400 publications, including 90 original research papers, monographs, and book chapters, and has secured millions of dollars in external grants supporting his research work. He is (1) a Fellow of the American College of Sports Medicine, (2) a Fellow of the American Society for Laser Medicine and Surgery, (3) listed among Who is Who in Science and Engineering (1991), (4) a Past-President of the World Association for Laser Therapy (WALT) (1998 – 2000), and (5) Co-Editor-in-Chief of Photomedicine and Laser Surgery journal.

His academic career has taken him to thirty-nine countries and all but five of the 50 states in the United States, either as a visiting professor, invited presenter, keynote speaker, visiting scholar, or as an invited guest of other universities.



### **Professor Michael Hamblin**

---

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 specialty of the Hamblin lab is the development of new animal models for testing PDT approaches. The study of how PDT can activate the host immune system to attack advanced cancer is a new direction in the Hamblin lab. A second focus is low-level light therapy (LLLT) for wound healing, arthritis, traumatic brain injury and hair regrowth.

Dr. Hamblin has published over 95 peer-reviewed articles, over 100 conference proceedings, book chapters and international abstracts, and he holds eight patents. He has edited the most recent and comprehensive textbook on PDT entitled "Advances in Photodynamic Therapy: Basic, Translational and Clinical". 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 conference at SPIE entitled "Mechanisms for Low Level Light Therapy".



## Dr Nicolette Houreld

---

Dr Houreld graduated with a doctoral degree in Biomedical Technology in 2007, after which she conducted a two year post-doctoral study at the Laser Research Centre, University of Johannesburg, where she is currently employed as a Senior Lecturer. Dr Houreld's research interest is low level laser irradiation and wound healing, specifically with applications in diabetic wound healing. She has co-supervised a number of students, has 21 journal publications, 8 conference proceedings and 1 chapter in a book.



## Professor Tiina Karu

---

Tiina I. Karu received the diploma in physical chemistry from Tartu University, Estonia, in 1970, the Ph. D. degree in photochemistry and chemical carcinogenesis from the National Cancer Research Center, Moscow, USSR, in 1974, and the degree of Doc. Sci. in biophysics from the USSR Academy of Science, Leningrad, in 1990. Over the last 30 years, her main scientific interests have been in the field of laser light-tissue interactions. She has authored three books (Photobiology of Low Power Laser Therapy, 1989, The Science of Low Power Laser Therapy, 1998, and Ten Lectures on Basic Science of Laser Phototherapy, 2007) and approximately 300 papers. Since 1980, Dr. Karu has been the Head of the Laboratory of Laser Biology and Medicine, Laser Technology Research Center, Russian Academy of Sciences, Moscow Region, Troitsk, Russian Federation.



## Insoo Jang MD

---

Department of Internal Medicine, Woosuk University Hospital of Korean Medicine, Associate Professor, College of Korean Medicine, Woosuk University, Jeonbuk, South Korea; Chair of Korean Medicine Association for Laser Therapy.

Insoo Jang MD (Korean Medicine) PhD is an Associate Professor of College of Korean Medicine, at Woosuk University, Jeonbuk, South Korea and working at the Department of Internal Medicine, Woosuk University Hospital of Korean Medicine since 2001. He graduated from premedical course and college of Korean Medicine at Woosuk University, and his PhD from Kyunghee University in 2002, was entitled: Study on the central neural pathway of the heart, Neikuan(EH-6) and Shenmen(He-7) with neural tracer in rats.

He is a specialist in internal medicine registered in the Ministry of Health and Welfare, Korea, and worked as a military doctor (Medical officer, First Lieutenant), Black Panther Air-Borne Brigade, Korean Army Special Force (1996-1999). Dr Insoo Jang was a visiting scholar in the University of North Carolina in Chapel Hill, School of Medicine, Department of Physical Medicine and Rehabilitation. NC, USA (2007-2008).

He is on the editorial board of three scientific journals (in Korean) and also working as a reviewer for the peer-reviewed journals (indexed by PubMed): Complementary Therapies in Medicine, Journal of Alternative and Complementary Medicine, Evidence Based Complementary and Alternative Medicine, BMC Complementary and Alternative Medicine, Journal of Acupuncture and Meridian Studies, and others. He is the Chair of Korean Medicine Association for Laser Therapy and, his research keywords are laser acupuncture, LLLT, the methodology of clinical research, and neurology.



### Dr Shigeyuki Nagai

---

Dr. Shigeyuki Nagai received his DDS from the Osaka Dental University, Japan in 1987 and studied at the Harvard School of Dental Medicine as a Clinical Fellow from 1989 to 1992 when he practiced at the Massachusetts Veterans Administration Medical Center in 1990 and the Mass. General Hospital in 1991.

Dr. Nagai serves as a board member of the Japanese Society for Laser Dentistry, the Academy of Laser Dentistry, Asia and Pacific Division of the World Federation for Laser Dentistry (International Society for Lasers in Dentistry), the Japanese Academy of Color for Dentistry and the Japan Society for Dental Anti-Aging. He is a committee member of the Japan Academy of Esthetic Dentistry, the Japan Society for Laser Surgery and Medicine and Japan Association of Microscopic Dentistry, a vice president and chief instructor of the Japanese chapter of the Academy of Laser Dentistry, an adviser and chief instructor of the Japan Erbium Dental Laser Academy. He is also a member of International Society for Oral Laser Applications, and Academy of Microscope Enhanced Dentistry. He was awarded the Leon Goldman Award for Clinical Excellence in Laser Dentistry in 2010 from the Academy of Laser Dentistry in 2010 and the Excellent Presentation Prize of the Japanese Academy of Color for Dentistry in 2008. Dr. Nagai maintains a full-time practice in Tokyo, Japan.



### Dr Raj Nair

---

Raj is the Discipline Head of Oral Medicine, Oral Pathology and Human Diseases at Griffith University and Oral Medicine Consultant at the Department of Haematology and Oncology, Gold Coast Hospital, Queensland Health, Australia. Raj received his Oral Medicine training from Harvard University, USA and University of London, England, UK and his PhD from the University of Hong Kong in 1996.

His clinical training and interests are in the field of oral medicine, management of orofacial diseases, orofacial manifestations of medically-complex diseases, and orofacial supportive care in cancer therapy and hematopoietic stem cell transplantation. He maintains an out-patient oral medicine intra-mural practice providing much needed care for complex orofacial diseases, biopsy service and cancer screen at Griffith Health Clinics and in-patient care to cancer patients at the Gold Coast Hospital.

He has widely published and has presented a number of original research papers internationally and has given invited lectures world-wide. Raj holds membership and leadership roles in both professional and research bodies including American Academy of Oral Medicine, British Society of Oral Medicine; International Association for Dental Research; Multinational Association of Supportive Care in Cancer and International Society for Oral Oncology (MASCC/ISOO). He has been an invited consultant and member of international consensus bodies such as World Workshop in Oral Medicine, World Workshop in Oral Health and Diseases in AIDS and Oral Mucositis and Oral Care in Cancer Study Groups of MASCC/ISOO.

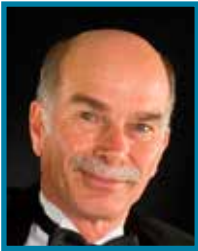


### Professor Uri Oron

---

- B.Sc and Ph.D (Biology) from Tel-Aviv University in Israel.
- 1977-79 Harvard University: post doctoral training in muscle physiology.
- In 1979 joined the academic staff of Tel Aviv University, Faculty of Life Sciences where he is currently a full Professor. Main field of interest is Regenerative Medicine.

- Sabbatical year (1985-86) at Case Western Reserve University (muscle and bone regeneration) and another year (2002-3) at UCSD and PhotoThera Inc. working on biomodulation of ischemic heart by low level laser therapy.
- Professor Oron is an author of more than 90 peer reviewed scientific papers; thirty five of them are on biostimulation of cells and tissues with low level laser therapy.



## Professor Neil Piller

---

Neil is a Professor in Lymphology, Director of the Lymphoedema Research Unit and advanced studies coordinator in the MD Graduate Entry Medical Program, School of Medicine, Flinders University. He coordinates a specialist elective for Post Graduate Medical Students in Lymphatics and Lymphoedema.

He was President of the 22nd International congress of Lymphology and is a member of the Executive boards of the World Alliance for Wound and Lymphoedema Care, the International Lymphoedema Framework, and the Canadian, American and Australian National Frameworks. Prof Piller is Australasian Editor of Lymphatic Research and Biology, Clinical Sciences Editor of the Journal of Lymphoedema and editorial board member Lymphology, Phlebology and the Chinese Journal of Oncology and Lymphology.



## Dr Shimon Rockkind

---

- Specialist in Neurosurgery and Microsurgery
- Director, Division of Peripheral Nerve Reconstruction, Department of Neurosurgery, Tel Aviv Sourasky Medical Center, Tel Aviv University, Israel
- Director, Peripheral Nerve Reconstructive Institute
- Fellowship Director, Microsurgery for Peripheral Nerve at the Tel Aviv Sourasky Medical Center. The fellowship is affiliated by American Society for Peripheral Nerve
- Board Member of Peripheral Nerve Surgery Committee of the World Federation of Neurosurgical Societies
- Editorial Board Member of 5 international medical and scientific journals
- Reviewer of 27 international medical and scientific journals
- Publications: Author of 61 peer review articles, 7 review papers, and 29 chapters in books.



## Professor Hong Sai Loh

---

- Former Dean, Faculty of Dentistry, National University of Singapore
- Senior Consultant, National University Health System, Singapore
- Former President, World Federation for Laser Dentistry (WFLD)
- Chairman, Asia Pacific Division, WFLD
- Graduated in 1972 and worked more than 35 years in National University of Singapore as an oral and maxillofacial surgeon. Started laser applications since 1986, and was involved in WFLD since its inception in 1988.





### Associate Professor Sajee Sattayut

---

Sajee Sattayut graduated with a Doctor of Dental Surgery (First Class Honors) at the Khon Kaen University in 1993 and has received specialist training on Laser use in Oral and Maxillofacial Surgery, at the London Hospital Medical College between 1995- 1998. Sajee was awarded the Doctor of Philosophy in oral and maxillofacial surgery by the London University in 1998. He has been appointed the Associate Professorship in Oral Surgery, Faculty of Dentistry, Khon Kaen University since 2003 and was invited to be the honorary secretary of Asia Pacific Division WFLD during 2010 to 2012.



### Professor Jan Tunér

---

Jan Tunér is a dentist in private practice, graduating from the Karolinska Institute in Stockholm in 1968. He has been using LLLT clinically since 1986 and is the author of several books on LLLT. During the last decade he has been involved in clinical research and is the co-author of 18 PubMed listed papers, four of these performed in cooperation with the Karolinska Institute. Among other activities he was the founder of The Swedish Laser Medical Society in 1989 and its international internet site LaserWorld, in cooperation with Lars Hode. His most recent creation is the LaserAnnals, an internet based journal on LLLT research analysis. Dr. Tunér was the membership secretary of WALT 2000-2010.



### Professor Laurence Walsh

---

Professor Laurence Walsh has an international reputation in dental applications of laser technology, and has presented over 300 invited lectures and courses on that topic at international and national levels. He has been the Head of the University of Queensland, School of Dentistry since 2004. Laurence holds a personal chair in dental science and leads a research team whose focus is on translational aspects of advanced diagnostic and treatment technologies using lasers and other technology platforms. He has been using lasers in general and then in specialist dental clinical practice for over 20 years, and has published extensively on both basic science and clinical aspects of laser use. He has authored over 200 journal papers which have attracted over 3200 citations, and he is the co-inventor of 6 families of patents.



### Professor Kenji Yoshida

---

- Professor of Department of Oral and Maxillofacial Surgery, School of Dentistry, Aichi-Gakuin University
- General Secretary of WFLD (World Federation for Laser Dentistry).
- Dye Chairman WFLD Asia – Pacific Division.
- President of JSLD (Japanese Society for Laser Dentistry) since 2009.
- Board member of JLSM (Japanese Society of Laser Surgery and Medicine)
- President of the 31th Annual Scientific Meeting of JLSM (2010).
- Board member of JLTA (Japan Laser Therapy Association) President of the 25th Annual Scientific Meeting of JLTA (2013).

## WALT Executive Committee Members

### Professor Heidi Abrahamse

---

Director, Laser Research Centre in the Faculty of Health Sciences at the University of Johannesburg.  
President of the World Association for Laser Therapy

### Professor René-Jean Bensadoun

---

Professor and Head, Radiation Oncology Department University Teaching Hospital, Poitiers (France).  
WALT Membership Secretary

### Professor Jan Bjordal

---

Professor and Vice Rector, Research and Internationalisation, Bergen University College, Norway.  
WALT Scientific Secretary.

### Dr Roberta Chow

---

General practitioner currently in practice at Castle Hill Medical Centre, Castle Hill Sydney

### Professor Chukuka Enwemeka

---

Distinguished Professor and Dean of the College of Health Sciences, University of Wisconsin–Milwaukee

### Dr. Nicolette Houeild

---

Laser Research Centre (LRC), University of Johannesburg. Treasurer of WALT.

### Assoc Prof Liisa Laakso

---

Head of Physiotherapy and Deputy Head of the School Rehabilitation Sciences, Griffith University (Gold Coast campus). WALT President-elect.

### Professor Rodrigo Lopes Martins

---

Professor at the Department of Pharmacology, Institute of Biomedical Sciences, University of Sao Paulo  
Secretary of WALT.  
WALT General Secretary

### Dr Shimon Rochkind

---

Specialist in Neurosurgery and Microsurgery, Director, Division of Peripheral Nerve Reconstruction, Department of Neurosurgery Tel Aviv Sourasky Medical Center, Tel Aviv University, Israel

## WALT Organising Committee

### Co-Chairs:

A/Prof Liisa Laakso and Dr Roberta Chow

### Ordinary members:

Peter Jenkins  
Ann Liebert  
Dr Mark Rogers  
Phil Gabel  
Dr Ambrose Chan  
Prof David Baxter  
Penny Smalley  
Dr Raj Nair

### Assisted by:

Cath Young  
Sharon Tilley  
Ann Winnall

## WALT Scientific Committee

### Co-Chairs:

Dr Roberta Chow and Prof David Baxter

### Ordinary members:

Prof Gordon Waddington  
Prof Neil Piller  
Prof Patsy Armati  
Prof Loh Hong Sai  
A/Prof Liisa Laakso

### Assisted by:

International panel of abstract reviewers



## Congress Program

The committee would like to thank the platinum sponsor  
Your Healthy GP for making this program possible.



### DAY 1: Friday 28 September

6:30am	<b>Beach Walk – Meet Phil Gabel in Hotel Lobby</b>		
7.30 – 8.30am	<b>Registration with arrival tea and coffee – Including Posters</b>		
	Pipeline		
	<b>Chairperson:</b> A/Prof Liisa Laakso (WALT2012 Committee)		
8.30 – 9.00am	Welcome to Country <i>and</i> Official opening		
9.00 – 9.30am	<b>Keynote: Prof Mike Hamblin</b> <i>Transcranial low level laser (light) therapy: mechanisms and application to traumatic brain injury and beyond</i>		
9.30 – 10.00am	<b>Invited Speaker: Prof Juanita Anders</b> <i>Light interaction with the peripheral nervous system: in vivo and in vitro models of neuropathy</i>		
10.00 – 10.30am	<b>Morning Tea (Trade Expo Area) – Including Posters</b>		
	<b>Dentistry</b> Point Break	<b>Tissue healing</b> Diamond Head	<b>Cancer</b> Longbeach
	<b>Chairperson:</b> A/Prof Sajee Sattyut & Dr Shigeyuki Nagai	<b>Chairperson:</b> Prof Chukuka Enwemeka	<b>Chairperson:</b> Prof Heidi Abrahamse
10.30 – 11.00am	<i>Phototherapy in Dentistry: Research and Clinical Indications: I</i> <b>Prof Aldo Brugnera</b>	<i>Advances in Photobiomodulation for Bacterial Eradication</i> <b>Invited Speaker: Prof Chukuka Enwemeka</b>	<i>Global DNA Methylation Status of Colorectal Cancer Cells Exposed to Photodynamic Therapy</i> <b>Invited Speaker: Prof Heidi Abrahamse</b>
11.00 – 11.15am	Laser Therapy in Dentistry – where do we stand? <b>Prof Jan Tunér</b>	<i>Clinical Laser Phototherapy in Hospital and Community Nursing</i> <b>Tina Czech</b>	<i>Phototoxic effect of photodynamic therapy on lung cancer cells grown as a monolayer and three-dimensional multicellular spheroids</i> <b>Sello Manoto</b>
11.15 – 11.30am		<i>LLLT and biological dressings: a new solution for treatment in chronic wounds</i> <b>Ana Maria Pinto</b>	<i>Localisation and toxicity of sulfonated zinc phthalocyanine photosensitizer in photodynamic therapy of colorectal adenocarcinoma cells (CaCo-2)</i> <b>Palesa Sekhejane</b>
11.30 – 11.45am		<i>Managing complex and recalcitrant wounds with low-intensity laser therapy</i> <b>Slava Kim</b>	<i>Down-regulation of heat shock protein 27 induced resistance to photodynamic therapy in oral cancer cells</i> <b>JiSun Kim</b>
11.45 – 12.00pm		<i>The Effect of GaAIs laser on chemical and thermal wounds healing</i> <b>Milad Karamlou</b>	<i>Follow-up results and efficacy of using low power near IR phototherapy in patients with prostate cancer following radiotherapy</i> <b>Roberta Chow</b>
12.00 – 12.15pm	<i>LLLT for neuropathy caused by the dental treatment</i> <b>Prof Kenji Yoshida</b>	<i>In vivo median nerve anastomosis using chitosan-rose bengal adhesives</i> <b>Antonio Lauto</b>	<i>Low power visible and near IR light in oncology: review of preclinical and clinical data</i> <b>Roberta Chow</b>
12.15 – 12.30pm	<i>Effects of low level laser therapy on nerve remyelination – an animal study</i> <b>Prof Loh Hong Sai</b>		
12.30 – 1.15pm	<b>Lunch – Bazaar Restaurant</b>		
	<b>Dentistry</b>		<b>Dose Consideration</b>
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida		<b>Chairperson:</b> Peter Jenkins (WALT2012 Committee)
1.15 – 1.30pm	<i>Modifying laser-induced shock waves for clinical endodontics</i> <b>Roy George</b>		<i>The DOSE: a minute to learn, a lifetime to master</i> <b>Lars Hode</b>
1.30 – 1.45pm	<i>Pre conditioning and low level laser therapy in dental practice</i> <b>Arun Darbar</b>		<i>Is there a threshold in the dose-effect relationship for LLLT?</i> <b>Hans Romberg</b>

# THE SPECTRUM OF LASER – TRANSLATING BASIC RESEARCH TO CLINICAL OUTCOMES

	Dentistry Point Break	Diamond Head	Pain: New Approaches Long Beach
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida		<b>Chairperson:</b> Phillip Gabel (WALT2012 Committee)
1.45 – 2.00pm	<i>In search of dental anesthesia</i> <b>Gerry Ross</b>		<i>The dose-response effects of low level laser therapy on pain and range of motion in patients with lumbar disc protrusion</i> <b>Kamran Ezzati</b>
2.00 – 2.15pm	<i>Low Level Light Therapy (LLLT) for Pain Reduction in Temporomandibular Joint Dysfunction</i> <b>James Carroll</b>		<i>Comparing the effects of 980NM and 830NM Lasers in pain controlling of knee osteoarthritis</i> <b>Soheila Mokmeli</b>
	Dentistry		Pain: Spine and Lower Limb
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida		<b>Chairperson:</b> Phillip Gabel (WALT2012 Committee)
2.15 – 2.30pm	<i>Modified ILIB technique: clinical experience and new perspectives</i> <b>Daiane Meneguzzo</b>		<i>Low level laser therapy in treatment of acute low back pain with radiculopathy</i> <b>Nenad Milovanovic</b>
2.30 – 2.45pm	<i>Immediate and long term effects of Nd:YAG laser irradiation and in-office desensitizing treatment on tubule occlusion</i> <b>Milena Palazon</b>		<i>Effect of Low Level Laser Therapy on chronic Lower Back Pain</i> <b>Manasi Gaikwad</b>
2.45 – 3.15pm	<b>Afternoon Tea (Trade Expo Area) - Including Posters</b>		
	Dentistry	Basic Sciences	Pain: New Approaches
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida	<b>Chairperson:</b> Dr Roberta Chow (WALT2012 Committee)	<b>Chairperson:</b> Dr Mark Rogers (WALT2012 Committee)
3.15 – 3.30pm	<i>LLLT for TMD and oral lesions</i> <b>A/Prof Sajee Sattyut</b>	<i>Blue light irradiation of Methicillin resistant Staphylococcus aureus (MRSA) and human dermal fibroblast</i> <b>Violet Bumah</b>	<i>New concept, new therapeutic approach to chronic pain</i> <b>Weixing Yan</b>
3.30 – 3.45pm		<i>Evaluation of Photoactivated Disinfection using Light-Emitting Diode on Bacterial Growth of Aggregatibacter actinomycetemcomitans: an in vitro study</i> <b>Pardis Soleimanzadeh Azar</b>	<i>Implementation of the LANCET review protocols for chronic cervico-thoracic pain: a clinical case series</i> <b>Phillip Gabel</b>
	Dentistry	Basic Sciences	Sport and Performance
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida	<b>Chairperson:</b> Dr Raj Nair	<b>Chairperson:</b> Prof Jan Bjordal
3.45 – 4.00pm	<i>LLLT Laser in Orthodontics</i> <b>Dr How Kim Chuan</b>	<i>Modulation of lipopolysaccharide-induced NF-kappa B signalling pathway by 635nm irradiation via heat shock protein 27</i> <b>WonBong Lim</b>	<i>Low level laser therapy inhibits muscle atrophy pathway in young males submitted to physical strength training</i> <b>Cleber Ferraresi</b>
4.00 – 4.15pm	<i>Pulsed Nd:YAG Laser Induces Pulpal Analgesia: A Randomized Clinical Trial</i> <b>Dr Ambrose Chan</b>	<i>Effect of 635 nm irradiation on high glucose, boosted inflammatory responses in LPS-induced MC3T3-E1 cells</i> <b>ByungKuk Kim</b>	<i>LLLT in the Immediate Treatment of Sports injuries from Club to Olympic athletes</i> <b>Phillip Gabel</b>
	Dentistry	Basic Sciences	Sport and Performance
	<b>Chairperson:</b> Prof Aldo Brugnera & Prof Kenji Yoshida	<b>Chairperson:</b> Dr Raj Nair	<b>Chairperson:</b> Prof Jan Bjordal
4.15 – 4.30pm	<i>Implantology and aesthetic dentistry</i> <b>Dr Shigeyuki Nagai</b>	<i>Preparation of a Vaccine against Diabetic Foot Pathogenic Bacteria using Low Level Laser Irradiation</i> <b>F Rostum Ihsan</b>	<i>Light emitting diode therapy (LEDT) and cryotherapy in skeletal muscle recovery after eccentric exercise</i> <b>Ernesto Cesar Leal Junior</b>
4.30 – 4.45pm	<i>The Use of Low Level Laser Therapy in Dentistry</i> <b>Gerry Ross</b>	<i>Effect of Low Level Laser Therapy in Immune Response During Acute Lung Injury</i> <b>Vivian Cury</b>	<i>Timing of Low Level Laser Therapy in Rat Achilles Tendon Injury</i> <b>Jon Joensen</b>
5.00 – 7.00pm	<b>Broadwater Sunset Cruise</b> (Buses leave QT Hotel at 5pm sharp. Delegates will be transported back to QT Hotel after the cruise.)		



## DAY 2: Saturday 29 September

6:30am	<b>Beach Walk – Meet Phil Gabel in Hotel Lobby</b>		
8.00 – 8.30am	<b>Registration with arrival tea and coffee – Including Posters</b>		
	Pipeline		
	<b>Chairperson:</b> Dr Roberta Chow (WALT2012 Committee)		
8.30 – 9.00am	<b>Invited Speaker: Prof Tiina Karu</b> <i>Cellular mechanisms of photobiomodulation behind the clinical findings</i>		
9.00 – 9.30am	<b>Invited Speaker: Prof Jan Bjordal</b> Pain stream sponsored by Menzies Foundation <i>Targeting pain relief with the anti-inflammatory mechanism of laser phototherapy</i>		
9.30 – 9.45am	<b>A/Prof Liisa Laakso</b> <i>Assessing clinical responsiveness to LLLT</i>		
9.45 – 10.00am	<b>Ann Leibert</b> <i>The role of channelopathies in pain and the implications for laser treatment</i>		
10.00 – 10.30am	<b>Morning Tea (Trade Expo Area) – Including Posters</b>		
	<b>Dentistry</b> Point Break	<b>Nervous Systems</b> Diamond Head	<b>Basic sciences : Stem cells and gene expression</b> Longbeach
	<b>Chairperson:</b> Prof Jan Tunér & Prof Laurie Walsh	<b>Chairperson:</b> Dr Roberta Chow (WALT2012 Committee)	<b>Chairperson:</b> Dr Nicolette Houreld
10.30 – 11.00am	<i>Laser safety – an update and some current issues in dentistry</i> <b>Invited Speaker: A/Prof Lee Collins</b>	<i>Effectiveness of Laser Phototherapy for Peripheral Nerve Recovery and Related Motor Function</i> <b>Invited Speaker: Prof Shimon Rochkind</b>	<i>Induction of autologous mesenchymal stem cells at the bone marrow by low level laser therapy has beneficial effects on the ischemic heart and kidney</i> <b>Invited Speaker: Prof Uri Oron</b>
11.00 – 11.15am	<i>New modalities of PDT and laser assisted immunotherapy in management of oral lesions</i> <b>Reza Fekrazad</b>	<i>The helmet experiment: an observation of the mechanism of action of LED-sourced infrared light</i> <b>Jonathan Stone</b>	<i>Potential use of low intensity laser irradiation in stem cell therapy</i> <b>Invited Speaker: Prof Heidi Abrahamse</b>
11.15 – 11.30am	<i>LLLT treatment in early bisphosphonate-related osteonecrosis of the jaw in patient with multiple myeloma</i> <b>Daiane Meneguzzo</b>	<i>Treatment of neuropathic pain and trigeminal neuralgia</i> <b>Gerry Ross</b>	<i>Low level laser therapy enhances the expression of osteogenic factors during bone repair in rats</i> <b>Ana Renno</b>
	<b>Dentistry</b>	<b>Basic Sciences</b>	<b>Basic sciences : Stem cells and gene expression</b>
	<b>Chairperson:</b> Prof Jan Tunér & Prof Laurie Walsh	<b>Chairperson:</b> Prof Tiina Karu	<b>Chairperson:</b> Prof David Baxter (WALT2012 Committee)
11.30 – 11.45am	<i>Laser therapy role in cell homing tissue engineering: improvement of dental pulp stem cells migration and differentiation</i> <b>Leila Ferreira</b>	<i>Down-regulation of nitrosative stress by photobiomodulation induced by 670nm light in an animal model of multiple sclerosis</i> <b>Jeri-Anne Lyons</b>	<i>Low level laser therapy (660nm) alters expression of genes during muscle regeneration in rats</i> <b>Natalia losimuta</b>
11.45 – 12.00pm	<i>Treatment of aphthous stomatitis using Low Level Laser Therapy (LLLT)</i> <b>Prof Jan Tunér</b>	<i>Mast cell response to low level visible and infrared laser, evidence of a mechanism for anti-inflammatory and pain relieving effects of low level laser therapy</i> <b>Weixing Yan</b>	<i>Low-level laser therapy modulates inflammatory response and contributes to muscle regeneration in rat tibialis anterior muscle after cryolesion</i> <b>L Assis</b>
	<b>Workshop</b>	<b>Lymphoedema</b>	<b>Muscle</b>
		<b>Chairperson:</b> Sharon Tilley (WALT2012 Committee)	<b>Chairperson:</b> Prof David Baxter WALT2012 Committee)
12.00 – 12.15pm	<i>Anti-Ageing Photomedicine</i> <b>Tina Czech</b>	<i>Lymphoedema and Low Level Laser: Sequencing and targeting in the treatment process</i> <b>Invited Speaker: Prof Neil Piller</b>	<i>The effects of Low Level Laser Therapy on injured skeletal muscle</i> <b>Daniel Ribeiro</b>
12.15 – 12.30pm			
12.30 – 1.30pm	<b>Lunch – Bazaar Restaurant</b>		
	<b>Workshop</b>	<b>Novel applications</b>	<b>Muscle</b>
	<b>Chairperson:</b> Prof Gordon Waddington	<b>Chairperson:</b> Ann Liebert (WALT2012 Committee)	<b>Chairperson:</b> Prof David Baxter WALT2012 Committee)
1.30 – 1.45pm	<i>Pain workshop</i> <b>Dr Roberta Chow and Prof Jan Bjordal</b>	<i>Case studies of Australian White-Tail Spider and String Ray bites and their management with Low Level Laser Therapy</i> <b>Phillip Gabel</b>	
1.45 – 2.00pm		<i>A Pilot Study on: Laser for Smoking Cessation and its Effectiveness at Six Months Follow-up</i> <b>Phillip Gabel</b>	



# THE SPECTRUM OF LASER – TRANSLATING BASIC RESEARCH TO CLINICAL OUTCOMES

	Workshop Point Break	Workshop Diamond Head	Workshop Diamond Head
2.00 – 2.15pm	Pain workshop (cont'd) <b>Dr Roberta Chow and Prof Jan Bjordal</b>	<i>The Use of Low Level Laser Therapy in Dentistry</i> <b>Gerry Ross</b>	<i>Quantum physics for dummies (Includes aspects of light distribution in tissue and power density for laser &amp; LED clusters)</i> <b>Hans Romberg</b>
2.15 – 2.30pm			
2.30 – 2.45pm			
2.45 – 3.00pm			
3.00 – 3.30pm	<b>Afternoon Tea (Trade Expo Area) – Including Posters</b>		
	Dentistry	Novel applications	Physics in Action
	<b>Chairperson:</b> Prof Loh Hong Sai & Dr How Kim Chuan	<b>Chairperson:</b> Prof Mike Hamblin	<b>Chairperson:</b> Penny Smalley
3.30 – 3.45pm	<i>Friendly photons what can be achieved with high level lasers in clinical dental practice</i> <b>Prof Laurie Walsh</b>	<i>Photobiomodulation attenuates retinal degeneration in a rodent model of retinitis pigmentosa</i> <b>Janice Eells</b>	<i>Laser Safety: Legislation &amp; Compliance in Queensland – Class 4 lasers</i> <b>Bruce Griffiths</b>
3.45 – 4.00pm		<i>A novel application of photobiomodulation in dry age related macular degeneration – results from the Toronto and Oak Ridge study (TORPA)</i> <b>Graham Merry</b>	<i>Laser Safety: Theory into Practice</i> <b>Penny Smalley</b>
	Dentistry	Bone	Physics in Action
	<b>Chairperson:</b> Prof Loh Hong Sai & Dr How Kim Chuan	<b>Chairperson:</b> Prof Mike Hamblin	<b>Chairperson:</b> Prof Jan Bjordal
4.00 – 4.15pm	<i>Laser Dentistry: What the future holds</i> <b>Prof Laurie Walsh</b>	<i>Effects of Low Level Laser Therapy on the Articular Cartilage in Experimental Model of Osteoarthritis</i> <b>Poliani Oliveira</b>	<i>Amplification, regulation, and a simple model for the biphasic dose-effect relationship for laser and LED phototherapy</i> <b>Hans Romberg</b>
4.15 – 4.30pm			<i>Skin penetration from pulsed-, continuous- and superpulsed low-level lasers</i> <b>Jon Joensen</b>
4.30 – 4.45pm	<i>Phototherapy in Dentistry: Research and Clinical Indications – II</i> <b>Prof Aldo Brugnera</b>		<i>Quantification of the Absorption of Low-Level 904nm Laser as a Function of Skin Color</i> <b>Ann Liebert</b>
4.45 – 5.00pm			<i>Laser Light Penetration. Measurement of Irradiance of Different Beam Profiles at Various Tissue Depths in Pig Tissue</i> <b>James Carroll</b>
7.00 – 11.00pm	<b>Gala Dinner (Pipeline)</b>		



# WALT

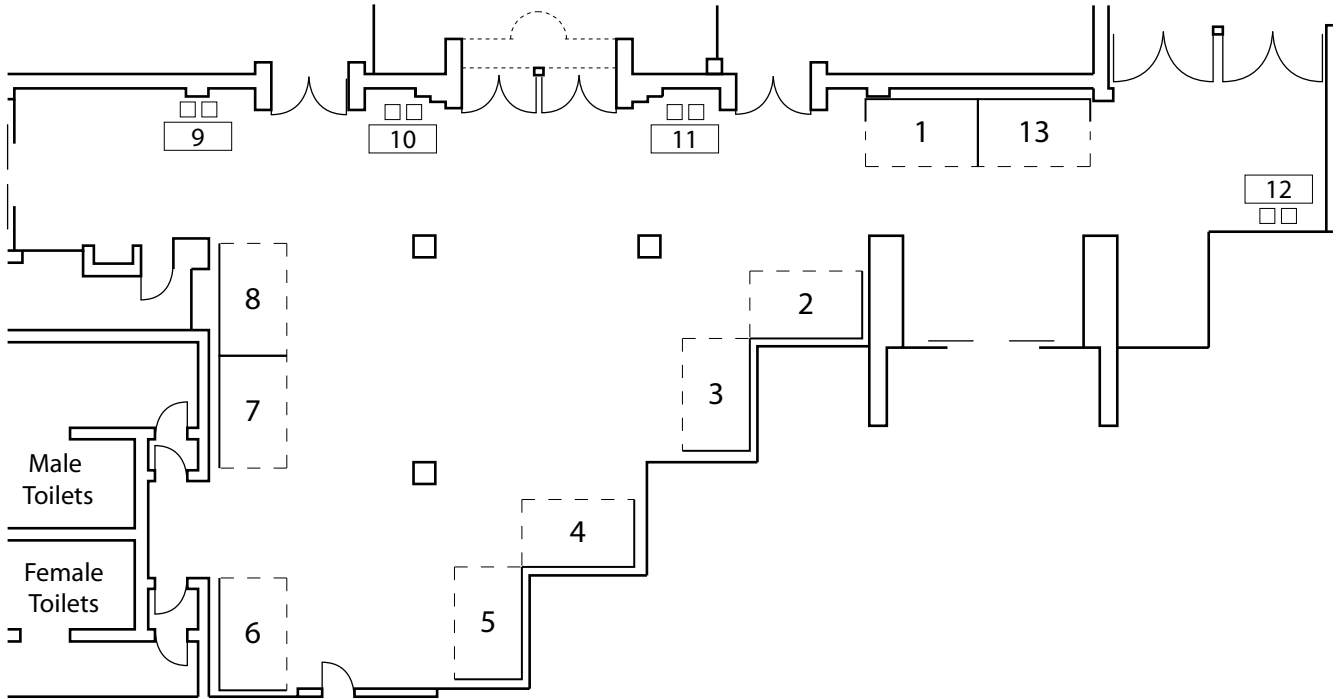
World Association for Laser Therapy



## DAY 3: Sunday 30th September

8.00 – 8.30am	Registration with arrival tea and coffee – Including Posters		
	Veterinary Applications Point Break	Novel Applications Diamond Head	Aesthetics Longbeach
	<b>Chairperson:</b> Peter Jenkins (WALT2012 Organising Committee)	<b>Chairperson:</b> Prof Juanita Anders	<b>Chairperson:</b> Tina Czech
8.30 – 8.45am	<i>Laser therapy in veterinary applications</i> <b>Dr Richard Godine</b>	<i>Sperm motility enhancement with Low Level Laser Therapy is both dose and sample dependent</i> <b>Phillip Gabel</b>	<i>Extensive Review of Low-level laser therapy for non-invasive body contouring</i> <b>Steve Shanks</b>
8.45 – 9.00am	<i>Veterinary case presentations..... Why I can't practice without LLLT</i> <b>Dr Ron Hirschberg</b>	<i>Effect of Low Level Laser Therapy with Diode Lasers (Red &amp; Infra Red) on Human Sperm Motility</i> <b>Elaheh Fekrazad</b>	<i>Application of laser therapy for dermatological conditions</i> <b>Slava Kim</b>
	Acupuncture	Novel Applications	Wound Healing
	<b>Chairperson:</b> Roberta Chow	<b>Chairperson:</b> Prof Juanita Anders	<b>Chairperson:</b> Tina Czech
9.00 – 9.15am	<i>Laser acupuncture: what we have learned so far?</i> <b>Dr Insoo Jang</b>	<i>Comparative Study – Use of red and infrared laser on cultured bacteria of strain Acetobacter xylinum using different doses</i> <b>Luciana Almeida-Lopes</b>	<i>Accelerating wound healing and skin loss sealing using Low Level Laser Therapy</i> <b>F Rostum Ihsan</b>
9.15 – 9.30am	<i>Laser-acupuncture for autism/autism spectrum disorder – a randomized sham controlled trial</i> <b>Shahzad Anwar</b>	<i>Modulation of chronic pain pattern with intravenous laser blood irradiation and enbrel in juvenile arthritis</i> <b>Constantin Ailioaie</b>	<i>Laser irradiation in the visible wavelength stimulates wound healing in vitro</i> <b>Invited Speaker: Nicolette Houreld</b>
	Acupuncture	Novel Applications	
9.30 – 9.45am	<i>Effects of transcutaneous 650nm and 808nm laser irradiation to a single point on rat sciatic nerve sensory and motor action potentials: implications for the clinical application of low-level laser therapy and laser acupuncture</i> <b>Dr Roberta Chow</b>	<i>Low power laser as a diagnostic device</i> <b>Gholamreza Majlesi Koopaei</b>	
9.45 – 10.00am		<i>Application of computer modelling to predict the effect of melanin concentration on treatment time</i> <b>Aletta Karsten</b>	
10.00 – 10.30am	Morning Tea (Trade Expo Area) – Including Posters		
	Pipeline		
	<b>Chairperson:</b>		
10.30 – 11.00am	<b>Invited Speaker: Dr Raj Nair (Prof Rene-Jean Bensadoun)</b> <i>Photomedicine using low level laser in orofacial complications of cancer therapy</i>		
11.00 – 12.30pm	Awards and closing ceremony Congress Close		

**Floor Plan**



**Exhibitors**

- Spectra-Medics Pty Ltd ..... 1
- BioFlex Laser..... 2
- THOR Photomedicine Ltd..... 3
- William Green Pty Ltd ..... 4
- Neuromagnetics Australia Pty Ltd ..... 5
- RJ – Laser, Reimers & Janssen GmbH..... 6
- Medlaser Equipment Industrial Limited ..... 7
- Your Healthy GP ..... 8
- Acupak ..... 9
- Pulse Laser Relief ..... 10
- QBMI PhotoMedicine..... 11
- Konftec Corporation..... 12
- Irradia..... 13



## Sponsors & Supporters



### Your Healthy GP

---

**Yourhealthygp.com** is an innovative group of healthcare practices, originally opened by Dr Mark Rogers in Adelaide in early 2009. Last year he established two practices in Sydney and Melbourne.

The practices specialise in the use of laser therapy for the treatment of migraine, tinnitus and soft tissue injuries. Dr Rogers, who has been involved in laser therapy for over 14 years, has travelled to Europe, USA and Canada on several occasions, specifically to train in techniques of low level laser light therapy. Dr Rogers has himself felt the benefit of treatment, and no longer suffers from migraines.

The application of near infrared light over soft tissue reduces inflammation and gives relief for both acute and chronic pain, allowing an increase in speed and quality of tissue repair.

The three practices employ trained laser therapists. To provide for quicker patient recovery, endermologie sessions for lymphatic drainage, and infra red saunas, are also available. An infrared digital photograph is also taken at the beginning and end of treatment to support the therapists in providing accurate treatment.

Posture is particularly important for recovery, so education and encouragement are provided to all patients, to help maintain the correct body positioning and minimise any pull on soft tissue injuries.



### Griffith University

---

Since opening its doors in 1975, Griffith University has come to be regarded as one of Australia's most innovative tertiary institutions and one of the most influential universities in the Asia-Pacific region and in the Top 5% worldwide.

Griffith University was the very first university in Australia to offer degrees in Asian studies and Environmental studies and it remains a pioneer in these fields. Griffith has grown to be a large multi-campus institution with internationally recognised strengths in teaching and research. The University now offers more than 300 degrees across five campuses and is home to more than 43,000 students from 131 countries. Griffith is Australia's ninth largest higher education provider. The comprehensive Gold Coast campus of Griffith University plays host to over 16,500 students from all over Australia and the world. Widely acknowledged for its strengths in Health, Griffith's Gold Coast Campus boasts state-of-the-art facilities. The new \$150 million Griffith Health Centre and the co-located \$1.76 billion Gold Coast University Hospital, are both scheduled to open in 2013.

### High Tech Laser

---



High Tech Laser are Australia's medical and dental laser specialists and have provided minimally-invasive dentistry tools to Australian practitioners for over 14 years. Matt Moncrieff and his experienced team understand the subtle differences between lasers and they have selected the best lasers in each wavelength from a number of leading suppliers worldwide. They will provide specialist advice on which lasers will be suitable for your practice. All of the lasers in the High Tech Laser range are sourced from manufacturers in Europe and the USA to ensure quality performance, high safety levels and consistent reliability.

A nationwide team of technical support staff will deliver superior after-sales service to ensure devices produce high standards of performance for many years. Their team can assist with marketing strategies to maximise your return on investment, staff training programs and ongoing education.

To request an information kit or register for demonstration nights contact High Tech Laser on **1300 309 233** or visit [www.hightechlaser.com.au](http://www.hightechlaser.com.au)



## LightForce Therapy Lasers by LiteCure Medical

---

LiteCure Medical is a leading medical device manufacturer focused on innovative laser therapy solutions within the markets of Musculoskeletal Rehabilitation and Pain Management. Combining laser science, engineering, and clinical research, LiteCure Medical offers the most complete solutions and support to our growing number of customers around the world.

The LightForce EX, with 15W of therapeutic power, is the ultra-premium platform within the high power segment. Influence™ Technology, a patented feature, allows for customized protocols based on individual patient characteristics. The interface includes 3D anatomical animation which creates a fantastic user-patient experience.

The NEW LightForce Pro is a great value option that also provides a high level of performance. 9W of power, embedded protocols, and functional portability, make the LightForce Pro the right choice for any practice. Its intuitive touch-screen software interface also makes the system easy-to-use.

Both of these platforms showcase the Empower™ Delivery System (DS) with four (4) interchangeable treatment heads. This unique delivery system, including the patented laser roller-ball, provides unparalleled flexibility and maximizes the effectiveness of every treatment.

For more information on LightForce® Therapy Lasers by LiteCure® Medical, visit [www.lightforcelasers.com](http://www.lightforcelasers.com) or email us at [info@litecure.com](mailto:info@litecure.com).



## SpectraMedics

---

SpectraMedics is a specialist manufacturer and supplier of photomedicine and laser therapy equipment for medical and veterinary practice and research.

Founded in 1996 by Peter A. Jenkins, SpectraMedics is one of the World's most trusted names in laser therapy equipment, and our integrity and commitment to excellence is evident throughout our product range and business practices.

Only products that conform to the highest standards of quality, safety and efficacy and that offer our customers outstanding value, ever make it into our catalogue. Our medical laser products include Irradia's MID-Laser and MID-Lite, and SpectraVET's PRO and ZEUS, and SpectraMedics' own Winning Edge and Equitec, comprise our veterinary laser range.

SpectraMedics also has the expertise to help you to determine the optimal system configuration for your specific needs, and with a comprehensive range from which to choose, chances are we have the system that's right for you.





## The Menzies Foundation

---

The Menzies Foundation was established in 1979 as a non-political, not-for-profit organisation to commemorate the life and achievements of Sir Robert Menzies, Australia's longest-serving Prime Minister. The Foundation supports prestigious postgraduate scholarships in allied health, engineering, law and medical research, and also provides leadership through workshops and initiatives on matters of national importance.

The Foundation has also nurtured excellence in health research through the Menzies School of Health Research in Darwin, the Menzies Research Institute of Tasmania in Hobart, and the Menzies Centre for Health Policy in Sydney and Canberra. Through its strategic investment in scholarships, research and ideas, the Foundation has achieved substantial leverage and national leadership in promoting Australia's health and well-being.

For further details:

T: 03 9419 5699 F: 03 9417 7049 E: [menzies@vicnet.net.au](mailto:menzies@vicnet.net.au)

"Clarendon Terrace", 210 Clarendon Street, East Melbourne Vic 3002

[www.menziesfoundation.org.au](http://www.menziesfoundation.org.au)

## Exhibitors



### Acupak Pty Ltd

---

Welcome to Acupak! Acupak Pty Ltd, Melbourne Australia supplies medical therapy equipment, particularly low power laser therapy units. Our standard model the CL Mini is an 8mW laser appropriate for laser acupuncture applications. Recently we have started to supply a new 60mW model, the CL Plus laser. It is a therapeutic laser designed for universal application on larger wounds, muscular-skeletal applications, physiotherapy as well as laser acupuncture. Acupak lasers are approved by the TGA (Australian Therapeutic Goods Authority). We stock a point finder for use with the above lasers.

Contact Acupak by email, phone or fax in Australia:

T: (03) 9822 5454 F: (03) 9822 5887 M: 61 413 412 146

International: 61 3 9822-5454. Fax. 61 3 9822-5887

Address: 9 Lawson Street East Hawthorn 3123

E: [acupak00@hotmail.com](mailto:acupak00@hotmail.com)

[www.acupak.com.au](http://www.acupak.com.au)

### BioFlex Laser

---

Meditech International Inc. was founded by Fred Kahn MD, FRCS(C) in 1989. Over the past 20 years, the company has developed the BioFlex Series of Low Intensity Laser Therapy Systems. BioFlex's patented technology offers clinicians the highest clinical success rates with predictable, reliable and reproducible results. Incorporating basic research, scientific knowledge and clinical expertise, the company has developed protocols for a vast array of medical conditions including soft tissue and sports injuries, arthritis, back problems, wounds and many dermatological problems. Protocols are refined on an ongoing basis at the Meditech Rehabilitation Centres where 800 treatments are administered on a weekly basis. Clinics using BioFlex Laser Therapy Systems are established worldwide and over 2 million treatments have been administered without any significant complication or adverse effects. Meditech offers an extensive array of educational programs including Laser Therapy



Certification Training, Advanced Certification Training, monthly online Webinars, Symposiums and Conferences. Please visit [www.bioflexlaser.com](http://www.bioflexlaser.com) for more information on our exciting product line, comprehensive marketing support, helpful technical and clinical services, and informative educational programs.



## **Konftec Corporation** **Improving life through the power in light™**

---

Founded in 2003, Konftec has enjoyed a leading reputation in low level laser therapy devices technology. Concentrating in developing therapeutic lasers, Konftec continues to create the new and efficient low level laser therapeutic modalities, provide LLLT treatment solutions widely spread availability by innovation and mass production to reduce the cost.

Konftec is:

- The FIRST double sided taping laser manufacturer for LLLT since 2001.
- The FIRST simultaneous operation, multi-channel laser acupuncture manufacturer since 2003.
- The FIRST multi-channel laser helmet manufacturer since 2003.

Currently, the annual production capacity of therapeutic lasers exceeds 10,000 units. The product line covers professional applications and home therapy devices – from battery operated laser to the advanced laser irradiation system of 60 lasers.

Our goal is to help people with developing and manufacturing the best LLLT system/device affordable by professional and home therapy.

We believe:

*There is but ONE True Medicine.*

*It matters not if medicine is old or new,  
so long as it can cure.*

*It matters not if theories come from East or West,  
so long as they are true.*

[www.konftec.com](http://www.konftec.com)



## **Medlaser Medical Equipment Ltd**

---

Medlaser Medical Equipment Ltd is specialised in designing and manufacturing for low level laser therapy (LLLT) and LED photobiomodulation systems. Medlaser is a fast growing medical equipment manufacturer since 2007, has its own 2 medical equipment manufactories by the standard of ISO13485, Medlaser firmly controls every steps of its products from sample design – 3D design – construction design – electronics design – prototype – diode testing – clinical trails – molding/tooling in-house – painting/electroplating – delivery to aftersales service. Medlaser earned the global reputation for high-end quality, innovation, customer oriented, competitive and excellent after-sale service.

Medlaser hot-sale products: several series of laser acupuncture healing systems; light therapy bed; laser/LED ear plugs (for Alzheimer's disease and winter depression); hair regrowth laser helmet, laser/ LED slimming system, etc. Medlaser is professional and experienced in OEM service and we are looking for international Medlaser distributors.

E: [info@medlaser.com](mailto:info@medlaser.com)

[www.medlaser.com](http://www.medlaser.com)



## Neuromagnetics Australia Pty Ltd

---

Neuromagnetics Australia Pty Ltd is a world leader in the research, design and manufacture of static magnet medical devices for the treatment of acute and chronic pain and fracture healing. Neuromagnetics is based on the premise that static magnetic fields can be optimised for therapeutic effects and is supported by many cell studies, animal studies, case studies and clinical trials.

Our signature product, Q magnets are patent pending and designed based on medical research and extensive clinical testing and feedback. Q magnets are becoming increasingly popular as an adjunct therapy since they are safe, inexpensive, effective, non-invasive and simple to use. They are used by some of the most forwarding thinking therapists and top athletes on the world stage, including: Australian Wallabies, Western Force, Queensland Reds, Brisbane Lions, Fremantle Dockers, BMW DTM Drivers and Australian sporting champions such as Simon Black, David Pocock and Shane Watson to name a few.

**Neuro-magnetics:** *Neuro for the nervous system, being the target of the therapeutic agent, an optimised inhomogeneous magnetic field for modulating pain relief.*



## Pulse Laser Relief

---

Pulse Laser Relief is a distributor of Low Level Laser Therapy devices for use by non medical professionals. The Pulse laser devices are designed to be used by patients under the direction of medical specialists. Pulse supports health professionals such as pain specialist doctors, dentists, physiotherapists, and chiropractors through supplying simple and relatively affordable lasers to their patients. Patient home treatment regimes that are prescribed by professionals in between clinic lasers treatments have been found to complement clinic treatments for a range of ailments. Pulse Laser Relief's mission is to increase the general public's awareness of Low Level Laser Therapy and its wide applications.

**[www.PulseLaserRelief.com.au](http://www.PulseLaserRelief.com.au)**

[Info@PulseLaserRelief.com](mailto:Info@PulseLaserRelief.com)

## QBMI™ PhotoMedicine

---

QBMI™ PhotoMedicine is a world-leader in the medical paradigm shift to the use of light in healing. We are the developer and provider of the authentic NIR LED patented medical devices developed with NASA to reduce pain. QBMI's technology delivers a powerful therapeutic dose of 5J/cm<sup>2</sup> of monochromatic light in only 88 seconds, without heat gain, to provide proven pain relief. Our tradition of rigorous research regarding the effects of photon energy on oral mucositis and many other disease states has led to our newest innovation, the QBMI 830/OM. To learn more about our research and products visit us at Booth #11 and on the web at **[www.qbmi.com](http://www.qbmi.com)**

## RJ-LASER – Photomedicine

---

The RJ laser system is based on more than 30 years of experience in development and production of medical laser devices (LLLT, low level laser). RJ laser devices offer therapy solutions for conventional and complementary medicine, for holistic treatment as modern ear acupuncture/auricular medicine and body acupuncture. RJ laser devices are available



as a stand-alone, handheld units (e.g. LaserPen) or as portable modular systems with single probe, multi-cluster probes, scanner, laser needle (LightNeedle).

[www.rj-laser.com](http://www.rj-laser.com)



## THOR Photomedicine Ltd

---

About THOR:

- Regulatory approval in Australia, Europe and USA
- Laser and LED treatment probes
- Wavelengths 660nm, 810nm and 850nm
- Single point probes, intra-oral (dental), acupuncture and cluster probe formats
- 10mW to as much as 2 Watts (in cluster probe format)
- CW and pulsed outputs
- Whole body light therapy canopy emitting 150W of 850nm
- Unique skin conduction diagnostic meter which detects trigger points on the body
- The most comprehensive training courses in the industry in 30 cities across the globe
- We teach the mechanism of action for tissue repair, anti-inflammatory effects, and analgesia, physics, dose calculation, how much dose is enough, how much is too much, safety, contraindications, hands on training, a four step treatment method that includes treating the injury, lymphatics, trigger points and nerves
- Online treatment database exclusive to THOR customers that grows every week with new indications
- We participate in research and maintain the most comprehensive research digest on the internet.

We strive to be the best informed company on LLLT and make products that perform to specification, are built to last and a joy to use.

[www.thorlaser.com](http://www.thorlaser.com)



## William Green Pty Ltd

---

William Green has been serving the Australian Dental Industry for over 65 years and is the only manufacturer of Dental units in Australia with the Tantus, Challenger and Vacujet Plus range. William Green is also a proud distributor for leading dental equipment manufacturers such as Carestream Digital Dental Systems, Ultradent Dental Units, Faro Operating Lights, Brumaba Surgical Tables, Elexxion Lasers, Tecnodent Chairs, BPR Swiss Mobile Dental Equipment, and Doctorseyes lighting systems.

Contact Evette Kellie :

T: (02) 8865 0314 or (02) 8865 0316

E: [ekellie@williamgreen.com.au](mailto:ekellie@williamgreen.com.au)

[www.williamgreen.info](http://www.williamgreen.info)



## Irradia

---

Founded in 1977, Irradia is a Swedish medical technology company specialized in laser therapy. Irradia develops, manufactures and markets laser instruments for LLLT, surgery and aesthetic use. Our unique MID laser system is used worldwide in clinical practice as well as in research.



## Poster Presenters

Poster displays will be available to view in the foyer for the duration of the Congress.

### **Constantin Ailioaie**

**University of Medicine and Pharmacy, Iasi, Romania**

---

*New challenges in treating pediatric rheumatic diseases with lasers in the age of biologic therapy*

### **Luciana Almeida-Lopes**

**NUPEN – Research and Education Center for Photo Therapy in Health Sciences, Sao Carlos, Brazil**

---

*Comparative Study – Use of different wavelengths of LED light sources in a culture of bacterium strain *Acetobacter xylinum**

### **Daryush Dayer**

**Iranian Medical Laser Association**

---

*Meta-analysis of Paradoxical Hypertrichosis as a side effect of Laser/IPL Hair Removal*

### **Helga Ferreira**

**Sao Leopoldo Mandic University**

---

*LLLT in the palliative cares protocol of oncological patients in the multidisciplinary team of Red Cross Hospital*

### **Debbie Frommer**

**Department of Medicine, Sydney University and The Children's Hospital, Westmead**

---

*Potential efficacy of low level laser therapy in treatment and management of Hypermobility Syndrome – a literature review*

### **F Rostum Ihsan**

**Faculty of Medicine – Al-Muthanna University**

---

*Effect of Low Level Laser on the Bacterial Isolations from Bile*

### **F Rostum Ihsan**

**Faculty of Medicine – Al-Muthanna University**

---

*Preparation of Abortion Pathogenic bacterial Vaccine using Laser Irradiation*

### **OkJoon Kim**

**Department of Oral Pathology, School of Dentistry, Chonnam National University**

---

*PDT-resistance of Autophagic cell death by HSP27 down regulation in oral cancer cells*

### **Carla Tim**

**Universidade Federal de Sao Carlos**

---

*Effects of Low level laser therapy in the process bone repair*

## Presenter Abstracts

**Heidi Abrahamse**

**University of Johannesburg**

---

### *Potential use of low intensity laser irradiation in stem cell therapy*

For decades low intensity laser irradiation (LILI) has been applied as therapeutic aid for the treatment of especially inflammatory conditions and tissue healing. Although recent focus has turned to the mechanism of action, this has not fully been explored and the idea of a non-invasive, non-thermal therapeutic tool for various regenerative processes has been identified and novel methods for determining further therapeutic applications are investigated. Augmenting stem cell based therapies using LILI holds potential for several applications that has been stymied in the past. The use of LILI for enhancing production of stem cell growth and differentiation, stimulation of angiogenesis, and directly augmenting proliferation of stem cells have been studied and demonstrated. Combining LILI with allogeneic and autologous stem cells, as well as post-mobilisation direction of stem cells requires extensive further investigation considering the vast contribution that this treatment modality may introduce for a variety of diseased conditions. Adipose tissue is derived from the mesenchyme, is easily isolated, a reliable source of stem cells and able to differentiate into different cell types including smooth muscle. Over the past few years, the identification and characterisation of stem cells has led to the potential use of these cells as a promising alternative to cell replacement therapy. Smooth muscle is a major component of human tissues and is essential for the normal functioning of many different organs. LILI has been shown to increase viability, protein expression and migration of stem cells in vitro, and to stimulate proliferation of various types of stem cells. 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, we have studied the effect of different irradiation wavelengths and fluences on ADSC viability and proliferation. Current work is focussing on the potential of LILI to induce differentiation into ADSCs in co-culture with smooth muscle cells.

**Heidi Abrahamse**

**University of Johannesburg**

---

### *Global DNA Methylation Status Of Colorectal Cancer Cells Exposed to Photodynamic Therapy*

#### **Background:**

DNA methylation is defined as a chemical modification without changing the DNA sequence. DNA methylation is an important regulator of gene expression and has been associated with human cancers. Low intensity laser irradiation (LILI), or biostimulation, is used in conjunction with photosensitisers in photodynamic therapy (PDT) to treat cancers. This study aims to determine the effect of PDT on global DNA methylation.

#### **Methods:**

Colorectal cancer cells (CaCo-2) were irradiated with 5J/cm<sup>2</sup> at 680 nm. Zinc Sulphophtalocyanine (ZnPc) was used as photosensitiser (20µM). The demethyliser, 5-Aza-2-deoxycytidine (Aza), was added to cells at a concentration of 0.1 or 3µM. Cell morphology, viability and proliferation was determined and global methylation status was measured using gel electrophoresis.

#### **Results:**

Pictures that were taken of cells during the 72 hour incubation period have shown that the vacuoles that were present in some cells disappeared in the Aza 0.1 µM and control cells. The vacuoles in the Aza 3µM cell group appear to have increased after 72 hours. PDT had no effect on cell viability and proliferation on CaCo-2 cells. When 3µM Aza was added to cells, there was an increase in viability (P<0.001), however this increase was no longer significant when used in combination with PDT.





### **Conclusion:**

The combination of Aza and PDT did not affect the growth of CaCo-2 cells, however when compared to cells treated with Aza only there was a significant decrease. DNA methylation status of CaCo-2 cells has no effect on PDT using the parameters outlined above. This may be due to DNA repair mechanisms. More work on the effect of DNA demethylation and PDT is currently being conducted.

### **Constantin Ailioaie**

**University of Medicine and Pharmacy, Iasi, Romania**

**Co-Authors: Laura Marinela Ailioaie, Dragos Andrei Chiran, Adnana Jaramani**

---

#### *Modulation of chronic pain pattern with intravenous laser blood irradiation and Enbrel in juvenile arthritis*

Aim of this study was to investigate the effects of intravenous laser blood irradiation (ILBI) on the modulation of the chronic pain pattern in juvenile arthritis, moderate and severe forms, under pharmacological therapy with the biological agent Enbrel.

### **Patients and Method:**

20 patients (mean age 12.4 years), diagnosed with Juvenile Idiopathic Arthritis, were included into a randomized placebo controlled study.

- Group 1: (12 patients) received 5 intravenous laser therapy sessions, repeated monthly for 12 weeks. A laser device with three diodes: red (635nm), green (532nm) and blue (405nm), 5mW power each, in continuous wave was used 30 minutes every session (10 minutes each wavelength, in the following order: red, green and blue).
- Group 2: (8 patients), the control group, received only conventional therapy with Enbrel and placebo ILBI. The pain pattern and the degree of the freedom of the joints were assessed with two digital devices. Local research ethics committee approval was obtained. All patients or their parents signed the informed consent.

### **Results and Discussions:**

In the end, the patients in Group 1 had significant improvements in neck pain, muscle strength of thumb flexors and the degree of the joints freedom ( $p < 0.001$ ), compared to the control group. At the same time, there was observed a reduction in the deficit of the pain pattern, with 52.6% on the right side and 58.2% on the left side of the laser group, compared to only 33.3% on the right side and 31.6% on the left side of the control group. Enbrel and laser therapy were found to be safe and well tolerated. Conclusions. ILBI and Enbrel proved to be an effective method of complex therapy, opening new fields in the modulation of the chronic pain pattern in Juvenile Arthritis.

### **Constantin Ailioaie**

**University of Medicine and Pharmacy, Iasi, Romania**

**Co-Authors: Dragos Andrei Chiran, Laura Marinela Ailioaie, Mircea Sanduloviciu**

---

#### *New challenges in treating pediatric rheumatic diseases with lasers in the age of biologic therapy*

New advances in the management of pediatric rheumatic diseases include biologic therapy in the attempt to better control: daily persistent and nocturnal pain, abnormal laboratory findings, morning stiffness, systemic features and periosteal elevation and cortical destruction. Understanding the mechanisms through which laser photobiostimulation induces self-organising phenomena in pediatrics immune-mediated inflammatory diseases (IMIDs) is essential for improving its efficiency, combined with biological therapy in severe forms. It is proposed a new conceptual model proving that a self-organised cell-like complexity organically run or live by emitting photons. Knowing the scenario of self-organisation by which these complexities emerged, it is explained how laser irradiation can affect the health condition of a living organism. 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. 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. Successful treatments may combine the benefits of light at specific frequencies absorbed by the cells with biological therapy in IMIDs.

## Luciana Almeida-Lopes

**NUPEN – Research and Education Center for Photo Therapy in Health Sciences, Sao Carlos, Brazil**

**Co-Authors: MA Napolitano, MGB Silva, LM Zanardi**

---

*Comparative Study – Use of different wavelengths of LED light sources in a culture of bacterium strain Acetobacter xylinum*

Photo therapy has been used with the purpose to accelerate and improve the cicatricial model of a living organism. Different biological materials have been employed on search for a biocompatible and inert material for the use of biological curatives. Aiming to accelerate the production and improve the quality of a curative based on the bacterial cellulose membrane produced by *A. xylinum*, the strain had been irradiated during its production, with different doses and lengths of waves and, by fixing irradiance and dose.

Different LEDs with wavelength (peak) in blue (448nm), infrared (880nm), green (530nm), red (627nm) and amber (590nm) were used. The power of the equipment had been fixed on 100mW and each group had been divided into 2 subgroups: one irradiated group with 0.5J and one control group. Each flask contained 5 irradiation points: north, south, east, west and centre. Photographs were made for the macroscopic examination of visual analysis of the membranes; weighting and measures at its hydrated state so as to verify the amount of cellulose present in each one of them and micrographs (MEV) at the adjustments of x5 to x100, to analyse the micro fibers formed.

For the macroscopic examination, the membranes had been weighted and measured in its hydrated state, with no significant evidence to the cellulose production quantity in any of the groups (irradiated or control). At the micrograph of the irradiated groups, the most evident result was observed at the group with red LEDs, where an improvement to the model of cellulose micro fibres formation was verified, and giving rise to a more organised net with toughest and well delineated fibres.

There was no alteration to the amount of material produced by the strain, arriving to the conclusion that at the parameters worked, the LEDs did not accelerate the cellulose membrane production. As to its quality, when observing a more organized and polarized matrix, we concluded that the red LEDs had a positive influence on the membrane production, what will give rise to a more resistant and consistent coverage. With that purpose, traction and hardness tests are going to be carried out in phase 2 of the study.

## Luciana Almeida-Lopes

**NUPEN – Research and Education Center for Photo Therapy in Health Sciences, Sao Carlos, Brazil**

**Co Authors: MA Napolitano, MGB Silva, LM Zanardi**

---

*Comparative Study – Use of red and infrared laser on cultured bacteria of strain Acetobacter xylinum using different doses*

The low power laser has been used with the purpose to accelerate and improve the cicatricial tissue model of a living organism. Different biological materials have been employed on search for a biocompatible and inert material for the use of biological curatives. Aiming to accelerate the production and improve the quality of a curative based on the bacterial cellulose membrane produced by *A. xylinum*, the strain had been irradiated during its production, with different doses and lengths of waves and identical irradiances.

A 660nm and 808nm laser were used. The power of the equipment was of 100mW and each group was divided into 4 subgroups: control and irradiated (0. J, 1J & 2J). Each flask contained 5 irradiation points: north, south, east, west and centre. Photographs were made for the macroscopic examination of visual analysis of the membranes;



weighting and measures at its hydrated state so as to verify the amount of cellulose present in each one of them and micrographs (MEV) at the adjustments of x5 to x50, to analyze the micro fibres formed.

At the macroscopic examination of the membranes, weighting and measures did not demonstrate significant alterations to the amount of cellulose production in any of the groups. At the micrographs, its wider fiber and polarization strength were observed, giving rise to a more organised crystalline net of fibers at the groups irradiated with red laser at 0.5J.

There was no alteration to the amount of material produced by the strain, arriving to the conclusion that at the parameters worked, the laser did not accelerate the cellulose membrane production. As to its quality, when observing a more organized and polarized matrix, we concluded that the laser at 0.5 J applied a positive influence to the production of the membrane, giving rise to a more consistent coverage. With that purpose, traction and hardness tests are going to be carried out in phase 2 of the study.

### **Juanita Anders**

**Uniformed Services University of the Health Sciences**

**Co-Authors: Brian Pryor, Jason Smith, Xingjia Wu, Stephanie Alberico**

---

#### *Light interaction with the peripheral nervous system: in vivo and in vitro models of neuropathy*

Peripheral neuropathies are common debilitating disorders linked to diverse origins and degeneration of peripheral nerves. Using an in vitro diabetic model, we found that high glucose concentrations significantly suppressed rat cortical and dorsal root ganglion (DRG) neurite extension. Irradiation of these hyperglycaemic neurons with light (980 nm), at a power density of 10mW/cm<sup>2</sup> and a fluence of 50mJ/cm<sup>2</sup>, significantly promoted cortical neurite extension but did not improve DRG neurite extension. We hypothesized that the differential response of the cortical and DRG neurons to light was due to DRG mitochondrial hyperglycaemic mediated injury. Based on these data, we hypothesized that 980nm wavelength light applied transcutaneously along the course of a neuropathic peripheral nerve would be an effective therapy for peripheral neuropathy. A spared nerve injury model of neuropathic pain was used and all procedures were approved under an IACUC protocol. Sixteen anesthetized rats underwent surgery and were randomly divided into two groups: Control (no treatment) and Laser treated. On the 7th post-surgery day, treatment was begun. Two transcutaneous treatment sites were used: the DRG at the T13-L1 vertebral level and the lateral surface of the involved hind paw. At the DRG site, the probe was placed directly on the skin for 19 seconds at an output power of 1.25W. At the lateral surface of the paw the probe was 11 cm above the paw (20 secs, output power 1W). Von Frey measurements for mechanical allodynia were taken before surgery, 7 days after surgery, and two days following each light treatment. On days 11 and 15 after the start of the treatment, the treated group had significantly higher-pressure thresholds compared to controls, indicating an improvement in touch sensitivity. Based on this data, transcutaneous laser irradiation has the potential to revolutionize the control of neuropathic pain.

### **Shahzad Anwar**

**Anwar Shah Trust for CP & Paralysis**

**Co-Authors: Malik Muhammad Khan, Faiza Qazi**

---

#### *Laser-Acupuncture for Autism/ Autism Spectrum Disorder a Randomized Sham Controlled Trial*

##### **Objectives:**

To evaluate the efficacy, safety, and compliance of laser-acupuncture in children with autism spectrum disorder (ASD).

##### **Design:**

Randomised, sham controlled, double blind trial, with blinded evaluation, statistical analysis of results and standardised parent report.

##### **Subjects and Interventions:**

Children with ASD were randomly separated into two groups one receiving laser-acupuncture (LA) group (n=60)

and the other sham laser-acupuncture (SLA) group (n=56) matched by age and severity of autism. The LA group received laser-acupuncture for selected acupoints while the SLA group received sham laser-acupuncture to sham acupoints. A total of 24 LA and SLA sessions over 12 weeks were given. Primary outcome measures included Functional Independence Measure for Children (WeeFIM), Pediatric Evaluation of Disability Inventory (PEDI), Leiter International Performance Scale- Revised (Leiter-R), and Clinical Global Impression- Improvement (CGI-I) scale. Secondary outcome measures consisted of Aberrant Behavior Checklist (ABC), Ritvo-Freeman Real Life Scale (RFRLS), Reynell Developmental Language Scale (RDLS), and a Standardized Parental Report. Data were analysed by the Mann-Whitney test.

## Results:

There were significant improvements in the language comprehension domain of WeeFIM ( $p=0.02$ ), self-care caregiver assistant domain of PEDI ( $p=0.028$ ), and CGI-I ( $p=0.003$ ) in the LA group compared to the SLA group. As for the parental report, the LA group also showed significantly better social initiation ( $p=0.01$ ), receptive language ( $p=0.006$ ), motor skills ( $p=0.034$ ), coordination ( $p=0.07$ ), and attention span ( $p=0.003$ ). All children with ASD adapted to laser-acupuncture easily. Mild side effects of irritability during laser-acupuncture were observed.

## Conclusion:

A twelve-week (24 sessions) course of laser-acupuncture appears to be useful in improving specific functions in children with ASD, especially for language comprehension, social initiation, motor skills and self-care ability.

## L Assis

### UFSCar

---

*Low-level laser therapy modulates inflammatory response and contributes to muscle regeneration in rat tibialis anterior muscle after cryolesion*

Skeletal muscle injuries are routinely treated in rehabilitation centres. During rehabilitation of muscle injury therapeutic approaches that have a dual action, i.e. reducing the inflammatory process while optimizing muscle repair, would be helpful. Low-level laser therapy has been considered a safe and efficient technique for the clinical treatment of a variety of diseases and injuries. However, little is known about exactly how laser therapy is able to affect the cellular systems involved in muscle repair and what are the molecular mechanisms involved in these processes. The aim of this study was to evaluate the effects of laser therapy using two different fluences on molecular markers involved in inflammatory and regenerative muscle response after a cryolesion of the tibialis anterior muscle in rats. Forty-eight Wistar rats were divided into six groups: control; normal muscle submitted to  $4\text{J}/\text{cm}^2$  and  $8\text{J}/\text{cm}^2$  laser irradiation; injured muscle without treatment; injured muscle submitted to  $4\text{J}/\text{cm}^2$  and  $8\text{J}/\text{cm}^2$  laser irradiation. The injured region was irradiated daily for 4 consecutive days, starting immediately after the lesion, using an AlGaAs laser (continuous wave;  $808\text{nm}$ ;  $0.0028\text{cm}^2$ ;  $30\text{mW}$ ;  $10\text{W}/\text{cm}^2$ ; 4 and  $8\text{J}/\text{cm}^2$ ; 0.12 and 0.24J; 6 and 12s). The animals were sacrificed on the fourth day after injury. The injured muscle areas were quantified by morphometric analyses. Metalloproteinase-2 expression and activity were determined by immunoblot and zymography, respectively. Nitric oxide production was evaluated by Griess reaction. S-nitrosation of cyclooxygenase-2 activity was determined by biotin switch. Both laser therapy fluences reduced the percentage area in the injured muscle and increased protein expression and activity of metalloproteinase-2. Moreover, laser therapy decreased nitric oxide production, which led to a smaller fraction of cyclooxygenase-2 to be S-nitrosated. These results suggest that laser therapy could be an effective therapeutic approach for modulating inflammatory response and promoting skeletal muscle regeneration.

## Jan Bjordal

### Bergen University College

---

*Targeting pain relief with the anti-inflammatory mechanism of laser phototherapy*

Laser phototherapy has been used for 30 years to reduce pain from injury and musculoskeletal origin. From the first randomised controlled trial was published by Gallachi et al. in 1981, laser phototherapy has been used with varying success and hypotheses for therapeutic action. The anti-inflammatory effect from laser phototherapy was first



discovered in an animal study published in 1985, but it took many years before this knowledge was expanded upon and systematically used in clinical settings. Our research group and Japanese research groups have more recently demonstrated that the specific anti-inflammatory action of laser phototherapy also is at play in humans with arthritis and tendinopathy. There is also new evidence for increased levels of inflammatory cytokines in active myofascial trigger points, which may explain some of the beneficial results found for trigger point irradiation even when low doses of laser phototherapy are used. Inflammatory cytokines may be responsible for an intrafusal inflammation in muscle fibres, which then impairs the relaxation ability and increase muscle tension. Our research group has shown that laser phototherapy can reduce inflammation and improve the relaxation ability in animal smooth muscle fibres. And it is yet to be investigated if this effect can be translated to striated muscle fibres in humans.

The clinical laser phototherapy (LLLT) literature is constantly expanding, and more than 60 randomized controlled trials in tendinopathies, osteoarthritis and rheumatoid arthritis have been published. In addition, a dozen more laser phototherapy studies have been published in acute injuries or early postoperative pain control. There is mounting evidence that treatment directed at targeting the anti-inflammatory mechanism with appropriate WALT recommended doses over the pathology, results in better outcomes than laser phototherapy not adhering to WALT guidelines.

**Jan Bjordal**  
**Bergen University College**  
**Co-Presenter : Roberta Chow**

---

#### *Pain Workshop*

Chronic pain is predicted to reach epidemic proportions in developing countries in the next decade. Drugs are the primary modality currently used in pain treatment, though efficacy is limited, must often be taken long-term, are costly and have significant short and long term side effects. Low-level laser therapy (LLLT) has been used to treat painful conditions for several decades, is non-invasive, has minimal side effects and is "patient friendly". In spite of these advantages, acceptance of LLLT into mainstream medicine remains limited in part due to a lack of awareness of the body of evidence now available for both clinical effectiveness and mechanisms of action.

From a clinical perspective, using correct doses, for specific conditions with correct techniques is central to achieving optimal results. In this workshop we will focus on how to achieve the best results incorporating the WALT guidelines and parameters from a review of LLLT in neck pain. Underpinning these clinical applications is an understanding of the neurophysiology of pain and the multiple mechanisms, which are activated by LLLT. How these are relevant to the clinical application of LLLT will be addressed, particularly with individualisation of treatment approaches for different clinical conditions. This workshop will bring the basic science of LLLT from the bench to the bedside.

**Aldo Brugnera**  
**President of WFLD**

---

#### *Laser Phototherapy in Dentistry (LPT)*

The term Laser Phototherapy (LPT) has recently been adopted because the use of LEDs and other light sources showed positive results in the treatment of several pathologies. There are a considerable number of different types of Laser or LEDs systems used for this purposes. For therapeutic proposes, we use radiation intensities so low that it is thought that any biological effects that occur are due to the direct effects of radiation rather than the result of heating. Light is absorbed in irradiated tissue by a variety of chromophores that absorb photons and light is transformed into biochemical energy by multiple secondary reactions resulting on the restoration of cellular function, reduction in pain and inflammation, and enhancement of wound healing processes. Our laser research field in clinical use of lasertherapy, LEDs, dental pain, PDT, laser fluorescence, bone regeneration, implants, phototherapy on neurosensorial disturbances, dental bleaching and raman spectroscopy. In this lecture, we will present LPT research and clinical use in different pathologies, with emphasis on dentinal hypersensitivity with several etiologies, implantology, mucositis, odontalgia, tissue healing( post-operative).



Lasers should never be used without a precise diagnosis of the pathology to be treated, which demands profound knowledge of dental specialties, laser (LEDs) properties and irradiation parameters, such as wavelength (nm), power (W) input and output, power density or irradiance (W/cm<sup>2</sup>), energy density or fluence (J/cm<sup>2</sup>), duration of each session (seconds), frequency of treatment (weekly) and number of sessions, energy per point (J) and total energy (J), laser CW or pulse etc. LPT is currently part of modern dentistry.

## Violet Bumah

**College of Health Sciences, University of Milwaukee-Wisconsin**

**Co-Authors: Daniela Masson-Meyers, Chukuka Enwemeka**

---

*Blue light irradiation of Methycillin resistant Staphylococcus aureus (MRSA) and human dermal fibroblast*

### **Background:**

In previous reports, we showed that 470nm light kills up to 94% of MRSA colonies in vitro in one shot. In follow-up studies, we fine-tuned the protocol by using different energy fluences and repeated doses to achieve 100% bacterial eradication.

### **Objectives:**

Here, our aim is to report the effect of LED blue light irradiation on MRSA and human dermal fibroblasts, as well as the mechanisms involved in photo-eradication of MRSA.

### **Methods:**

We cultured and plated 3x10<sup>6</sup> and 7x10<sup>6</sup> CFU/ml of the US300 strain of MRSA, then irradiated each plate with 0, 165 or 180J/cm<sup>2</sup> of 470nm light and repeated the irradiation thrice at six-hour intervals. Whole cell proteins extracted from colonies of MRSA not photo-destroyed, were assessed for membrane integrity using electron microscopy. Separately, bacteriolytic enzyme profile of lysates was analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), and in yet another experiment, genomic DNA was extracted from treated and control colonies of MRSA, the *mecA* and *femA* genes amplified by PCR, and ran on agarose gel. Finally, monolayers of human dermal fibroblasts were cultured and irradiated as detailed above. Aliquots were obtained and cell viability assessed.

### **Results:**

Agarose gel electrophoresis showed the presence of *mecA* and *femA* genes from the genomic DNA amplified from isolated colonies in control and irradiated plates. Similarly, electron microscopy revealed intact cell walls in all three groups, and SDS-PAGE of whole cell protein did not show differences between the groups. Data on the viability of human dermal fibroblasts and the implications of these findings will be detailed at the conference.

### **Conclusion:**

These findings shed light on some of the primary mechanisms underlying photo-destruction of MRSA and the effect of irradiation on human dermal fibroblasts.

## James Carroll

**THOR Photomedicine Ltd**

---

*Low Level Light Therapy (LLLT) for Pain Reduction in Temporomandibular Joint Dysfunction*

### **Background:**

Temporomandibular Joint Dysfunction (TMJD) is a common cause of orofacial pain. Low Level Light Therapy (LLLT) has been shown to be effective in treating a variety myofascial and joint pains.

### **Objective:**

The purpose of this study was to conduct a randomised, patient blinded, placebo controlled clinical trial to determine the efficacy of LLLT as initial pain reduction therapy in TMJD patients.



### **Method:**

29 patients with TMJD pain present for longer than 6 months were randomized to receive either active or placebo laser and LED treatments. A four-step treatment approach was used targeting lymph nodes, joint, nerve and trigger points. 44 points were treated using three different treatment probes. The clinical intent was to reduce inflammation in the TMJ with LED, deactivate myofascial trigger points with laser around the TMJ and neck, induce a neural blockade (analgesia) by treating over nerves with laser and stimulate lymph nodes with LED. The probe and treatment specifications were: 810nm, 200mW laser, 30 seconds per point (5W/cm<sup>2</sup>, 6 Joules per point, 150J/cm<sup>2</sup>), a laser cluster comprising 5 x 810nm 200mW laser (1W aggregate, 5W/cm<sup>2</sup> each laser) for 30 seconds per point (6 Joules per point, 150J/cm<sup>2</sup>) and a cluster of 69 LEDs comprising 34 x 660nm 10mW each and 35 x 850nm 30mW (1.39W aggregate) 60 seconds per point, (50mW/cm<sup>2</sup> average power density, 1.2J per point, 3J/cm<sup>2</sup>). All subjects were treated 5 times within a 2-3 week period. Primary outcomes were measured by the change a visual analogue scale (VAS) for pain. Secondary outcomes measured include the short-form 36 for quality of life analysis. Measurements were taken at baseline and 1-2 weeks following treatment.

### **Results:**

The mean VAS score for active treatment improved by 36.93 from a mean of 59.46. The sham placebo therapy improved by 10.23 from a mean of 55.7 (p<.001). Significant improvements were seen also in the active group compared to the control in SF-36-physical scores (SF-36PCS) (p<.001) and SF-36 mental scores (SF-36 MCS) (p<.047).

### **Conclusion:**

A four-step treatment method including LED and laser LLLT was successful for significantly reducing short-term pain (measured two weeks post treatment) when applying the parameters in this study to chronic TMD pain patients.

## **James Carroll**

### **THOR Photomedicine**

---

#### *Laser light penetration. Measurement of irradiance of different beam profiles at various tissue depths in pig tissue*

Irradiance is an important parameter in LLLT, too little and there may be no stimulation, too much, and there may be inhibitory effects. The WALT guidelines state that irradiances over 100mW/cm<sup>2</sup> at the skin have been unsuccessful in superficial tendinopathies and osteoarthritis. Therapeutic targets can range from 0mm to 50mm deep in musculoskeletal pathologies, but it is unclear how much irradiance is needed at the skin to achieve adequate irradiance at the target tissue and how beam spot size affects this.

### **Objective:**

To measure irradiance of different beam spot sizes at various depths in pig tissue.

### **Materials and Methods:**

A 200mW 810nm CW laser was projected on to various thicknesses of pig tissue from 2.8mm to 3cm thick and irradiance measurements recorded. In a second experiment the beam spot size was adjusted in five steps from 0.025cm<sup>2</sup> (8W/cm<sup>2</sup>) to 1cm<sup>2</sup> (0.2W/cm<sup>2</sup>), and irradiance measurements were recorded at 3cm deep.

### **Results:**

A 200mW 810nm CW laser beam area of 0.025cm<sup>2</sup> (8W/cm<sup>2</sup>) at the skin surface achieved 129mW/cm<sup>2</sup> at 2.8mm<sup>2</sup> and 0.62mW/cm<sup>2</sup> at 3cm. This reduced to 0.3mW/cm<sup>2</sup> when the beam area was expanded to 1cm<sup>2</sup>.

### **Discussion:**

Radiance is among many other parameters (including wavelength, irradiation time, pulse structure) that determine primary and secondary photobiomodulation effects of LLLT. This experiment shows that for deep anatomical targets, smaller laser beams / higher irradiance on the skin surface achieves a higher irradiance at a 3cm target. However, these high surface irradiances exceed those recommended in the WALT guidelines for superficial tendons / synovial targets. In addition, small laser beams may not adequately treat the whole pathology as recommended in the WALT guidelines. A doctor / therapist / researcher must understand the pathology, the superficial and deep anatomical targets, the depth of the target tissue as well as the parameters of their laser system if they are to be constantly successful.

**Conclusion:**

Higher irradiance lasers achieve better penetration but may over-treat superficial targets. The doctor / therapist / researcher should know the irradiance of their laser system, the depth of the target tissue and the approximate irradiance at that target if they are to be constantly successful.

**Ambrose Chan**

---

*Pulsed Nd:YAG Laser Induces Pulpal Analgesia: A Randomized Clinical Trial*

**Aims:**

This double-blind, randomised, clinical trial investigated the effectiveness and underlying mechanism of neural inhibition of pulsed Nd:YAG laser induction of pulpal analgesia by comparing with 5% EMLA anaesthetic cream.

**Materials and Methods:**

Forty-four paired premolars, from 44 orthodontic patients (Human Ethics approval #HREC/93/8/4.2, Westmead Hospital, NSW, Australia) requiring bilateral premolar extraction from either dental arch were randomly assigned to receive either 'Laser plus Sham-EMLA' or "EMLA plus Sham-Laser' treatment. Analgesia was tested by Electric Pulp Tester (EPT) and the cutting of a standardised cavity. Cutting was terminated when subjects first felt sensitivity, the Visual Analogue Scale (VAS) and any numbness recorded. Statistical analyses were paired t-test, McNemar's test and chi-squared test ( $p < 0.05$ ).

**Results:**

Cavities were completed in 68% of Laser and 59% of EMLA-treated teeth, both with statistically significant EPTs-increases above baseline. No significant

**Roberta Chow**

---

**Nerve Research Foundation, Brain and Mind Institute, University of Sydney**

*Effects of transcutaneous 650nm and 808nm laser irradiation to a single point on rat sciatic nerve sensory and motor action potentials: implications for the clinical application of low-level laser therapy and laser acupuncture.*

**Objectives:**

To evaluate effects on nerve conduction of transcutaneous 650 nm and 808 nm laser irradiation (LI) to a single point over rat sciatic nerve; to compare these data with LI to four points and discuss its relevance to the clinical application of low-level laser therapy (LLLT) and laser acupuncture (LA). Background: Neural effects of LI are proposed as a mechanism for LLLT and LA. Laser irradiation delivered sequentially to four points inhibited sensory and motor nerve conduction in rat sciatic nerve but effects of the same total energy on a single point are unknown.

**Methods:**

Transcutaneous 650nm, 35mW, (1.1J or 4.4J), continuous wave (cw), or 808nm 450mW, (13.5J or 54J) cw LI, or sham LI, was applied for 30s, or 120s, to a single point overlying the mid-point of rat sciatic nerve. This was followed by measurement of i) somato-sensory evoked potentials (SSEP) and, ii) compound muscle action potentials (CMAP) at 10 and 20 min, 24 and 48 hr.

**Results:**

808nm LI for 120s increased SSEP amplitudes at 10 min. Neither 808 nor 650nm for 30 or 120s at any other time point changed conduction from baseline.

**Conclusions:**

Localised transcutaneous LI to a single point overlying the sciatic affects SSEP and CMAP differently when compared with LI delivering the same total energy to four points, which causes conduction block. This indicates that the area of distribution of photons is an important variable with clinical implications for LLLT and LA. Further research is required to define the relationship between total dose and area of delivery.



## How Kim Chuan

---

### *LLLT Laser in Orthodontics*

It has been emphasised that one of the most valuable treatment objectives in dental practice is to afford the patient a pain-free treatment. By the evolution of the laser applications, the dental surgeon aims to achieve this goal without analgesic drugs and painful methods. Orthodontic treatment is one of these concerns, that one of the major components of patient to reject this treatment is the pain accompanied during the different treatment phases. Another great concern of the patient is not to get through prolonged periods of treatment. The use of LLLT in orthodontics has been shown to reduce pain as well as increase the rate of tooth movement. The author would show clinical cases to illustrate the use of LLLT Laser in orthodontics.

## Lee Collins

---

### *Laser safety – an update and some current issues*

The principles of the safe use of lasers, especially Class 3B and Class 4, do not significantly change. However some details and the application of the principles do. The international body responsible for laser safety standard – the International Electrotechnical Commission – has working groups covering all areas of laser use, medical included. A current issue is a proposal to create a new laser Class 1C. This might involve an embedded higher class laser, but with measures to limit emission in use. In a medical example, these might include interlocks which prevent emission unless an applicator is firmly in contact with the skin, and any leakage is minor, predominantly skin scatter. Another matter is production of new, alternate laser labels, in particular for small devices, where the text of current labels may be difficult to read. Safe work with lasers as always relies on two core aspects – appropriate protective eyewear and making the laser safe when not in use, or the “standby” control. These measures still do not preclude accidents, particularly with incorrectly classified, or illegal devices such as 532nm green laser pointers. Reported accidents have resulted in sometimes significant eye damage. Persons responsible for laser safety in various jurisdictions should be aware of these issues.

## Vivian Cury

**Emergency Medicine Division, Faculdade de Medicina da Universidade de São Paulo**

**Co-Authors: Thais Lima-Salgado, Natalia Pinheiro, Carla Maximo Prado, Livia Assis, Ana lochabel Moretti, Heraldo Possolo Souza**

---

### *Effect of Low Level Laser Therapy In Immune Response During Acute Lung Injury*

#### **Background:**

Low level laser therapy (LLLT) is prescribed as adjuvant therapy for inflammatory diseases. Its effect on acute lung diseases is less known. Hence, we examined whether LLLT may ameliorate acute lung injury (ALI) induced by intratracheal Lipopolysaccharide (LPS) instillation.

#### **Methods:**

C57 black mice (n=10 per group) were treated with intratracheal LPS (5mg/kg) or phosphate-buffered saline (PBS). Six hours after intratracheal instillation, both groups (PBS and LPS) were irradiated on the skin in the region of the mid axillary line bilaterally with laser at 660nm, power output 30mW, fluency 10J/cm<sup>2</sup>.

#### **Results:**

We observed a marked decrease in the number of inflammatory cells present in alveolar, recovered by bronchoalveolar lavage in LPS + LLLT animals compared to LPS group alone ( $2.0 \pm 0.8$  x  $4.4 \pm 1.3$ , respectively  $p < 0.05$ ) as well as in the number of inflammatory cells infiltrated in lung interstitium ( $49.6 \pm 3.2$  x  $71.8 \pm 3.9$ ,  $p < 0.05$ ). There was also inhibition of F4/80 (macrophage surface marker) and MCP-1 (monocyte chemoattractant protein-1) expression in animals submitted to LPS + LLLT compared to the LPS-only group, as detected by quantitative PCR. In lung homogenates we

detected a marked decrease in cytokine levels (IL1 $\beta$ , TNF $\alpha$ , IL6, IL10) and ICAM-1 expression in animals of the LPS+LLLT group, compared to LPS-only animals. In animals treated with LLLT, we observed signals of polarization to a Th2 immune response (enhanced arginase and impaired HIF-1 $\alpha$  expression) compared to animals that were not irradiated.

## **Conclusion:**

LLLT decreases pulmonary inflammatory cell infiltration, cytokine and chemokine secretion and ICAM-1 expression in an experimental model of ALI. Moreover, LLLT appears to shift the balance to a more pronounced Th2, and therefore reparative immune response.

## **Tina Czech**

**Australian Institute of Laser Therapy**

---

### *Anti-ageing photo medicine*

#### **Workshop Objective:**

The phenomenon of ageing affects all organic structures and their functions. It is not a disease, but a condition, which increases susceptibility to illness and tissue degeneration on various levels, which is largely due to the hypo-reactivity of the ageing organism and its inability to correctly respond to various rivaling stimuli. During this 30 minute workshop we will examine the ageing process and the role of phototherapy to address the effects of ageing at the external aesthetic level and internal biological level. A review of the effects of laser photothermal skin rejuvenation in conjunction with the integration of non-thermal laser photo-biomodulation will also demonstrate the three dimensional changes that can be achieved with this combined phototherapy for the ageing face and body.

#### **Findings:**

Ageing is characterised by mainly catabolic processes, which lead to thinning of epithelial structures, including skin and is accompanied by hypotrophy of muscles and bone/joints with accompanying reduction in volume of parenchymal organs. Non-linear co-operative systems within living organisms respond to minute inputs of energy, described as amplification effect and are capable of responding to very specific windows in relation to frequency and intensity. Both intrinsic and extrinsic factors contribute to the ageing process and maintaining adequate energy production at a cellular and tissue level is of paramount importance in prevention of premature ageing. Adenosine tri-phosphate i.e. ATP provides the main source of energy required by cells for contraction, mobility, transportation through the counter-gradient membrane, synthesis and repair of DNA. As we age infection, metabolic disorders, accumulated foreign substances collaborate in damaging this fundamental mechanism, which can be appropriately stimulated with photo-biomodulation using low levels of laser energy.

#### **Conclusion:**

Activation of the Krebs cycle is a fundamental element of correct anti-ageing strategy, since it promotes ATP energy production to provide for the synthesis of amino acids, steroids, fatty acids, heme, etc. Studies demonstrating the solid state biochemistry that takes place within the connective tissue matrix of the body can occur either in or on, the solid filaments and collagen fibres. Communications in a living system occur via chemical and energetic interactions and the use of coherent oscillations in the visible and near infra- red frequencies recognise no boundaries at the surface of a molecule, a cell or biological organism, as they are all co-operate to maintain regulation of the whole living system. In the therapeutic setting the biological significance of coherency and the implementation of laser energy to support ATP production, immune defence and repair mechanisms, can also be visibly seen at an external aesthetic level.

## **Tina Czech**

**Australian Institute of Laser Therapy**

---

### *Clinical Laser Phototherapy in hospital and community nursing*

#### **Objective:**

To review and consider the biomodulating effects of low intensity laser therapy (LILT) on pain control and healing, and its role in nursing in both the hospital and community health-care settings.



**Findings:**

The biomodulating effects of LILT have been well substantiated in the literature and in a meta-analysis of studies relating to wound healing. This form of laser phototherapy has the potential to support healing in acute and chronic wounded tissue by enhancement of immune function, increased blood and lymph circulation, pain control and an overall accelerated rate of healing in all types of wounded tissue.

**Conclusion:**

Nurses are at the interface of acute hospital care and community management of chronic wounds and lymphoedema, and are ideally suited to administering LILT as part of their clinical care regime. A first line defence for diabetic and neuropathic conditions can be facilitated, and in some cases surgical amputation prevented. Moreover home-based community nursing care would be able to offer this painless, biomodulating and side-effect free phototherapy more regularly, especially to people who are house-bound or living in outlying regions of Australia and other remote areas of the world.

**Arun Darbar**

**ALD,WCLI,ACT,BACD,BDA**

**Co-Authors: Rita Darbar**

---

*Pre conditioning and low level laser therapy in dental practice*

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 could promote better quality healing and prepare the tissue to respond more favourably. Cases treated in our dental practice will be demonstrated with the protocols used. The science behind this concept will be examined in an effort to explain the results and to open discussion.

**Dariush Dayer**

**Iranian Medical Laser Association**

---

*Meta-analysis of Paradoxical Hypertrichosis as a side effect of Laser/IPL Hair Removal***Background:**

Regrowth of un-wanted hairs in treated area or other areas or Paradoxical Hypertrichosis, is a rare complication of Laser/IPL hair removal that despite of its importance, has not considered carefully by the physicians and researchers of the field of laser.

**Objectives:**

Evaluation of reports of appearance of Paradoxical Hypertrichosis after treatment of un-wanted hairs with the laser/IPL devices durin 1990 untill 2012, determining of risk factors and etiologic factors that may result in this phenomenon.

**Methods:**

By reviewing of textbooks, published articles in dermatology and cosmetic journals, and published articles in Internet (AAD, Pubmed, Cochrane and Elsevier) related to hair removal procedures and their side effects with emphasis to Paradoxical Hypertrichosis and prevalence of this phenomenon and probable etiologic and predisposing factors that may related to it.

**Results:**

This phenomenon is a rare complication of hair removal procedures with the IPL devices and Ruby, Alexandrite and Diode Laser systems, but it's occurrence is more probable with IPL systems. About 5% of women with mediterranean, middle-east or east indian ethnicity had the experience of this side effect after the hair removal with IPL/Laser hair removal. The exact mechanism of this condition is unknown, but it appears that it would be more

common in specific phenotype that has many dark vellous† hairs distributed on their faces with non-regular frontal hair line. Many of these persons have hormonal disturbances and are in pre-menopausal age that may be associated with† conversion of vellous hairs to terminal hairs. The lower fluences of IPL/Lasers also may be related to induction of terminal hairs. Activation of hair follicles in adjacent areas and difference of TRT of Melanocytes of hairs that may result in insufficient destruction of hair follicles are other probable mechanisms that may result to this condition.

## **Conclusion:**

Paradoxical Hypertrichosis is a phenomenon that appears as a result of constant and long time irritation of hairs in treated or adjacent areas of face and body after treatment of unwanted hairs with IPL/Laser devices. The exact etiology of this condition is unknown but the ethnicity, difference in TRT of melanocytes of hair follicles, sublethal dose of radiation that is insufficient for follicular destruction and excess growth of adjacent hair follicles are some of the theories that may explain the causes and this phenomenon. Avoidance of treatment of dark skin types with test of procedures before treatment of large parts of face and body may reduce the occurrence of Paradoxical Hypertrichosis.

## **Janice Eells**

**Biomedical Sciences, College of Health Sciences, University of Wisconsin-Milwaukee**

**Co-Authors: S Gopalakrishnan, B Abroe, H Schmitt, P Summerfelt, A Dubis, S Maleki, M Ranji, J Carroll**

---

## *Photobiomodulation attenuates retinal degeneration in a rodent model of retinitis pigmentosa*

Photobiomodulation (PBM) by light in the far-red to near-infrared (NIR) region of the spectrum has been demonstrated to attenuate the severity of neurodegenerative disease in experimental and clinical studies. The purpose of this study was to test the hypothesis that a brief course of 830nm PBM would protect against the loss of retinal function and improve photoreceptor survival in a rodent model of retinitis pigmentosa, the P23H transgenic rat. P23H pups were treated once per day with 830nm light (180s; 25mW/cm<sup>2</sup>; 4.5J/cm<sup>2</sup>) using a light-emitting diode array (QBMI Photomedicine, Barneveld WI) from postnatal day (p) 10 to p25. Sham-treated rats were restrained for 180 seconds, but not exposed to NIR light. The status of the retina was determined at p30 by measuring photoreceptor function by electroretinography (ERG), retinal morphology by spectral domain optical coherence tomography (SD-OCT) and retinal metabolic state by NADH/FAD redox imaging. NIR treatment preserved retinal function, retinal morphology and retinal metabolic state in NIR-treated animals in comparison to the sham-treated group. In NIR- treated rats the rod-mediated ERG response was  $14.8 \pm 2.2\mu\text{V}$  compared to  $8.8 \pm 0.7 \mu\text{V}$  in sham- treated animals ( $P < 0.05$ ,  $n=4$ ). SD-OCT studies showed that NIR treatment preserved the structural integrity of the retina. Mitochondrial redox imaging (NADH RR) studies showed that NIR treatment ( $1.02 \pm 0.2$ ) protected against the shift towards a more oxidized state seen in the sham treatment ( $0.80 \pm 0.1$ ). Results from this study demonstrate the retinoprotective effects of 830nm PBM in a widely studied animal model of retinal degeneration and support the use of PBM as an innovative, non-invasive therapeutic approach for the treatment of retinal degenerative disease. [Support: JE: FFB (TA-NP-0709-0465-UWI), IRRF, NIH (EY001931). JC: NIH (EY017607, EY001931, EY014537), MCW Research Affairs Committee, RBP Career Development Award. M.R: UWM RGI, CTSI KL2].

## **Kamran Ezzati**

**University of Social Welfare & Rehabilitation**

**Co-Authors: Neureddin Karimi, Kimia Esmaeili**

---

## *The dose-response effects of low level laser therapy on pain and range of motion in patients with lumbar disc protrusion*

### **Objectives:**

To assess the effectiveness of low level laser therapy on pain and range of motion in patients with lumbar disc protrusion.

### **Patients and Methods:**

A sample of convenience of 45 patients was randomly assigned to 3 groups ( $n=15$ ) including: High dose LLLT group (Dose= 40J/cm<sup>2</sup>, age=37/88  $\pm$ 8/4, mass= 67/42  $\pm$ 8/6), Low dose LLLT group (Dose= 7J/cm<sup>2</sup>, age=39/88  $\pm$ 8/4, mass= 65  $\pm$ 6/6), and control group (age=39/23  $\pm$ 8/9, mass=68/94  $\pm$ 10/5). The study was double blinded and all patients in each group treated with LLLT 3 times per week for 15 sessions. Pain and range of motion were measured pre and post



treatment with a visual analogue scale and clinical tests. K-S statistical analysis was used to show normal distribution of data. Between-group comparisons of all data were performed with ANOVA ( $p < 0.05$ ).

#### **Results:**

Qualitative, anthropometric and quantitative variables revealed no significant differences between the three groups before treatment. The results showed a significant difference in pain and ROM of patients in the low dose LLLT group after treatment ( $p < 0.05$ ). On the other hand, these variables did not reveal any significant differences in high dose LLLT and control groups ( $p > 0.05$ ).

#### **Conclusions:**

Low dose LLLT may be effective in decreasing pain and improving ROM in patients with lumbar disc protrusion.

*Keywords: low level laser therapy, pain, lumbar disc.*

### **Elaheh Fekrazad**

**Faculty of Medicine, Islamic Azad University of Tehran, Iran**

**Co-Authors: Hossein Keihan, Hanieh Nokhbatolfoghahaie, Reza Fekrazad**

---

#### *Effect of Low Level Laser Therapy with Diode Lasers (Red & Infra Red) on Human Sperm Motility*

Sperm motility depends on energy consumption. Low-level laser irradiation increases energy supply to the cell. The aim of this study was to analyse whether laser irradiation affects the parameters that characterize human sperm motility. Each fresh human sperm sample was divided into three groups. Two groups irradiated with varying types of wavelength diode lasers: a 660nm Red laser and a 810 nm Infrared laser (irradiation mode: continuous-wave CW), at energy density of  $4\text{J}/\text{cm}^2$ . The other group acted as the control. At zero, 15, 30, 45, 60, 90, and 120 minutes following irradiation, each group was evaluated for four (4) motility parameters with computer-aided sperm analysis (CASA). Total motile sperm and progressive motility in irradiated groups was statistically and significantly different when compared to the control group ( $P < 0.01$ ). In this study both lasers irradiation improved the motility of human spermatozoa and might be a useful adjunct technique to enhance semen quality in Assisted Reproductive Techniques (ART).

### **Reza Fekrazad**

**Laser Research center in Dentistry, Tehran University of Medical Sciences**

**Co-Authors: Katayoun Kalhori**

---

#### *New modalities of PDT and laser assisted immunotherapy in management of oral lesions*

In non-invasive photodynamic therapy a photo-sensitizer substance is transferred into the body through the skin. When target cells, e.g. cancer cells and pathogenic bacteria, have accumulated the substance they are irradiated with photons that have specific physical parameters, particularly wavelength. As a result, free radicals of oxygen are created and the Hydrogen Peroxide generated gradually kills the target cells. In conventional photodynamic therapy a triangular relationship exists: photosensitizer (PS), photon, and oxygen. Literature shows that the presence of sufficient oxygen has a major role in singlet oxygen production. This event along side with photochemical interaction between laser photons and PS leads to gradual death of the cell homing processes. Recently, applying nanoparticles and immunological mechanisms has explained a new approach to treating diseased cells, whether cancerous or micro-organisms. The dominant interaction is photo-thermal. In this new method, despite the common photodynamic therapy method, increasing a few degrees of temperature would lead to decreased enzyme function and protein denaturation, and finally death of cell or micro-organisms. This is especially important when you are dealing with cancerous tumours at a depth where there is lack of oxygen, also in infectious lesions like periodontal packets where the majority of microorganisms are anaerobics. One of the best known ways is to adhere nanoparticles to special antibodies and transfer them to immunological cells that penetrate the region; their interaction with photons from a light source, especially laser, can lead to the death of the target cells or micro-organisms. This process can be likened to the story of the Trojan horse. Probable applications of some other new modalities in Oral Lesions such as Laser-Assisted Immunotherapy, and systemic photodynamic therapy will be discussed.

## Cleber Ferraresi

Federal University of Sao Carlos

**Co-Authors: Anderson Cunha, Iran Malavazi, Rodrigo Reiff, Rodrigo Panepucci, Euclides Junior, Michael Hamblin, Vanderlei Bagnato, Nivaldo Parizotto**

---

### *Low level laser therapy inhibits muscle atrophy pathway in young males submitted to physical strength training*

The human muscle performance during exercise can be related to differential expression of genes involved in protein degradation, pain and inflammation. There is strong evidence that low-level laser therapy (LLLT) decreases pain and inflammation by down-regulating interleukins and cytokines, but there is no evidence of LLLT effects on atrophy gene expression in humans. This study aimed to test whether a physical strength training program associated with LLLT can modulate the expression whole human genome by microarrays analysis. The Ethics Committee on Research in Humans of Federal University of São Carlos approved this study. Ten healthy male volunteers were randomly allocated into two equal groups: TLG (training associated with LLLT group) and TG (training group). In order to analyse gene expression, all subjects underwent biopsy of the vastus lateralis muscle before and after the training program. The training was carried out in leg press 45°, intensity at 80% of the individual subjects one repetition maximum test (1RM leg), twice a week for 12 weeks. Infrared laser irradiation (808nm) was applied on the quadriceps muscle of TLG subjects immediately after each training session, total dose 50J per session. The groups were compared using repeated measures ANOVA and Tukey's test HSD post-hoc. The percentage of up and down regulation of gene expression was compared between groups with the Mann-Whitney test. Preliminary microarray analysis showed a down regulation of the atrophy pathway only in the TLG group: TLG vs TG for IL-1 (-66% vs -16%,  $p < 0.001$ ), NFK (-7% vs -1%,  $p = 0.033$ ) and MuRF1 (-32% vs -8%,  $p = 0.047$ ). LLLT could modulate the human muscle atrophy pathway, suggesting a break in the inflammation, pain and atrophy cycle. This finding would be relevant to both patients in rehabilitation and athletes undergoing an intense training program. This study was supported by FAPESP and CEPOF.

## Helga Ferreira

Sao Leopoldo Mandic University

**Co-Authors: Joaquim d'Ameida, Ricardo Neves, Sandro Izádio, Leila Ferreira, Daiane Meneguzzo**

---

### *LLLT in the palliative care protocol of oncological patients in the multidisciplinary team of Red Cross Hospital*

According to the World Health Organization (WHO) palliative care that is provided by a multidisciplinary team promotes the patients' and their family's quality of life. The Odontology members of the team bring Low Intensity Laser Therapy (LILT) as an adjuvant protocol to treat pain resulting from the side effects of cancer treatment. This work shows the benefits of the inclusion of LILT in the palliative care of 18 oncological patients treated at the Red Cross Hospital (RCH), Barra do Pirai, RJ, Brazil. The patients had head and neck cancers, most of which were squamous cell carcinoma. The patients were treated with chemo and radiotherapy. All had oral mucositis. The LILT was applied daily. Patients received a mean of 15 sessions, energy of 4 Joules, scanning 1 cm<sup>2</sup> (2mm from the lesions) using both red (660nm) and infrared (810nm) diode lasers (100mW). From the first session of LILT all patients showed pain relief, accelerated healing of wounds, and improvement in swallowing. The LILT benefits complemented the effectiveness of palliative care, and proved to be very important for the quality of life of these patients.

## Leila Ferreira

Ibirapuera University

**Co-Authors: Shiwei Cai, Juliana Barros, Shalizeh Patel, Wei Chen, Marcia Marques**

---

### *Laser therapy role in cell homing tissue engineering: improvement of dental pulp stem cells migration and differentiation*

One of the biggest challenges of tissue engineering involves the inoculation of stem cells into the body. The processes involved can result in loss of viability of most cells and, in some cases, require patient immunosuppression. A cell homing technique was developed in order to attract stem cells that are already in the body



to the site of injury. Signals were provided via biomaterials and growth factors to which cells migrated and differentiated. Due to its cellular biostimulatory effects Laser Therapy (LT) could be of great importance for the cell homing approach. The objective of this study was to analyse the effects of LT, whether combined or not combined, with growth factors, on the migration and odontogenic differentiation of human dental pulp stem cells (hDPSC). hDPSC were cultured in regular or differentiation medium, treated with LT (660nm, continuous, punctual, 0.028cm<sup>2</sup>, 20mW, 5J/cm<sup>2</sup>, 7s). Treated cells were combined (or not combined) with BMP-2 or PDGF-BB growth factors. Cell differentiation was assessed by qRT-PCR (genes DSPP, DMP-1 and OCN), alkaline phosphatase activity and mineralized nodule formation. To evaluate cell migration cells were cultured in the presence (or absence) of BMP-2 or PDGF-BB, and submitted to LT using different powers and times of irradiation. A device used to test horizontal and vertical migration (against gravity) and to count migrated cells stained with calcein AM. Data were submitted to ANOVA and Tukey's test ( $p < 0.05$ ). The most striking feature on odontogenic differentiation induction of hDPSC was observed when LPT was associated with BMP2. Also, LPT stimulated horizontal migration and three dimensional cell migration against gravity in vitro. Thus, laser therapy could have clinical application in promoting cellular recruitment to the site of injury and improving cell differentiation for tissue engineering purposes.

### **Debbie Frommer**

**Department of Medicine, Sydney University and The Children's Hospital, Westmead**

---

#### *Potential efficacy of low level laser therapy in treatment and management of Hypermobility Syndrome – a literature review*

Studies already support the use of low-level laser therapy (LLLT) for conditions that have overlapping symptomatology with Hypermobility Syndrome. This review proposes an extension of the current use of LLLT to include Hypermobility Syndrome management. Hypermobility Syndrome is one of the most common hereditary connective tissue disorders. It affects approximately 5% of the adult Caucasian population and accounts for 45% of general rheumatology referrals, yet it is poorly understood, under-diagnosed, and therefore poorly managed. Some patients encounter few clinically significant problems in their life, whilst others progress to develop recurrent or chronic symptoms. Fragility and laxity of the connective tissue, and poor proprioception and motor patterns, lead to joint and muscle pain that predisposes to further trauma. Consequently, recurrent sprains and dislocations, enthesopathies and over-use disorders are common. Likewise, excessive neural tissue movement can lead to cervicogenic headache and carpal tunnel syndrome. Only recently has a much wider spectrum of symptoms, including prevalence of chronic pain, and gastrointestinal and autonomic dysfunction, started to be recognized. The lack of diagnosis and recognition of these symptoms results in poor management and predisposes patients with Hypermobility Syndrome to susceptibility to further trauma and pain. Historically, management has included motor retraining, postural and ergonomic changes, and pharmacological intervention. Current research into low-level laser suggests efficacy in treating symptoms prevalent in Hypermobility Syndrome, including acute and chronic pain, neuropathies, inflammation and motor trigger points. In this review I will examine the prevalence of various Hypermobility Syndrome symptoms, and the role that laser can play in both their prevention and management. This review will also propose a biomechanical, multidirectional model to explain the pathophysiology of these symptoms, and identify crucial points where laser treatment can be utilised as a new tool in the management of Hypermobility Syndrome.

### **Chukuka Enwemeka**

**College of Health Sciences University of Wisconsin**

---

#### *Advances in Photobiomodulation for Bacterial Eradication*

Bacterial resistance to drugs is a major problem in health care. Despite the emergence of stronger antibiotics, outbreaks of Methicillin resistant Staphylococcus aureus (MRSA) infection are rampant and are of major concern worldwide. As a paradigm shift, we explored the use of blue light to eradicate MRSA and showed that 405nm and 470nm light kill as much as 94% of MRSA colonies in vitro. However, new data from our lab indicate that the remaining colonies continue to grow actively; prompting our recent attempts to achieve 100% clearance of the deadly bacteria. Our results show that the bacteria must be irradiated repeatedly at high dosages in order to attain 100% clearance. The denser the bacteria culture, the higher the dose and the more number of treatments needed to achieve 100% eradication. These and other findings suggest that it may be possible to sterilize infected wounds and ulcers, and that



superficial layers of bacteria are readily susceptible to 405nm or 470nm light. Colonies further below the Petri dish seem less susceptible to photo-eradication because of the limited depth of penetration of blue light.

This presentation will summarise and discuss ongoing efforts to:

1. improve the irradiance and depth of penetration of 470nm light so that more MRSA colonies are effectively eradicated at clinically desirable lower safe doses
2. efforts to ensure 100% bacterial clearance, (3) failed attempts to eradicate bacteria with 810nm light, popularly used for wound healing and tissue repair, and (4) success in clearing other deadly bacteria with 470nm light.

## Philip Gabel

University of the Sunshine Coast

---

### *Case studies of Australian White-Tail Spider and Sting Ray bites and their management with Low Level Laser Therapy*

These case studies consider Low Level Laser Therapy (LLLT) as an adjunct in outpatient management of two bites. First, a white-tail spider (Lamponidae family, non-web-dweller famous due to erroneous scientific reporting for 'flesh-eating' necrosis) bite to the abdomen of a 43 year old female producing a painful, swollen 20cm<sup>2</sup> lesion, treated Day One; secondly, a stingray (elasmobranchs, ocean bottom-dwelling, non-aggressive flat-body cartilaginous fish) puncture to the foot of a 38 year old female surfer treated one week after wounding. LLLT is a logical treatment adjunct in both settings due to positive analgesia, lymphatic flow and wound healing effects.

#### **Case 1:**

White-tail spider standard management was followed by the General Practitioner with wound care, rest, analgesia and anti-histamines. Initial LLLT treatment (104-cluster LED-probe, 2W-output 55x10mW, 660nm and 48x30mW, 850nm) was 60 Joules with two 120 Joules follow-up treatments over one week. Significant local reaction response occurred within two hours (~20% swelling area increase), then subsided rapidly. Pain was 3/10, increased to 6/10 then reduced to 2/10 by day three and 0/10 with area 4cm<sup>2</sup> at discharge.

#### **Case 2:**

Stingray management during week one was standard elevation, analgesics compression and repeated very-hot water immersions (30–90 minutes) to denature protein-based poison and normalize nerve conduction. No antidotes are known. Puncture wounds heal slowly and may ulcerate. LLLT (GaAlAs 5x200mW cluster probe) initial dose was 60 joules increased to 75 then 90 joules for three treatments over one week. Baseline pain 6/10, swelling circumference +3cm and global function at 35%. Day 2 pain reduced to 4/10, swelling +2cm, function 50% and pain 3/10; and at discharge swelling 1cm and function 60%.

#### **Conclusion:**

The LLLT reduced total recovery time based on previous individual history. Further investigation is required to understand the LLLT effect on spider and stingray venom and the clinical course of reaction if LLLT is to be advocated as an adjunct to existing management protocols.

## Philip Gabel

University of the Sunshine Coast

Co-Authors: Keith Harrison

---

### *Sperm motility enhancement with Low Level Laser Therapy is both dose and sample dependent*

The study aim was to quantify the effects of Low Level Laser Therapy (LLLT) on human sperm motility in-vitro. Photo-bio-modulation effects of LLLT on human tissue from both diode and LED sources at wavelengths from 630 to 1000nm are well recognised but limited data exists on spermatozoa. The intracellular effects arise predominantly from stimulation of ATP production via the respiratory chain of the mitochondria. LLLT has been shown to improve human and canine sperm motility and calcium transport within murine spermatozoa. Three human semen specimens were



subjected to LLLT from two continuous output sources at varied distances using the Thor-Laser system: 104 LED diode cluster of 660nm and 850nm (1.77–28.32J/cm<sup>2</sup>), and a 200mW laser 810nm GaAlAr diode (0.66–2.66 J/cm<sup>2</sup>). Sperm motility of test and control aliquots was assessed using the sperm motility index (SMI) and the total functional sperm count (TFSC) parameters measured with a SQAIB analyser. The bio-modulation from both light sources was consistent across samples with different degrees of effect. The SMI and TFSC increased up to four fold compared to controls with an inhibitory effect at higher doses. The maximum effect post-exposure varied with the light source, being the lowest dose at 30 minutes for the LED cluster and the intermediate doses at 15 minutes for the diode laser. These results demonstrate that human sperm motility is modified by exposure to LLLT with an effect that is both dose and sample dependent. This justifies further study of samples varying in quality at different wavelengths and source types, plus determination of the longevity of the enhancement effect and verification that it is not detrimental to DNA integrity.

**Philip Gabel**  
**University of the Sunshine Coast**

---

*LLLT in the Immediate Treatment of Sports injuries, from Club to Olympic athletes*

Immediate sports injury management follows standardised protocols of RICE, i.e. Rest, Ice, Compression and Elevation, and avoiding HARM, i.e. Heat, Alcohol, Return to sport and Massage. The use of electrotherapy modalities is commonplace, with Low Level Laser Therapy (LLLT) prominent, though its action in acute injury management is often misunderstood. LLLT is a valid treatment for acute soft tissue sports injuries as actions at the cellular, organelle and atomic levels plus systemic and organism levels are supported. By understanding these principles of photo-bio-modulation, the rationale for LLLT in the arsenal for acute sports injury management is better comprehended. LLLT affects living tissue through multiple pathways that are determined by the wave effect of light in addition to the quantum particle effect. These pathways include local, segmental and systematic effects.

Local effects include actions at the site and time of irradiation:

1. effects on locally generated ATP through the respiratory chain of the mitochondria
2. polarization on the eucaryotic cells membrane lipid bi-layer
3. influences on the formation of singlet oxygen that neutralises free radical action and
4. influences on the permeability of fascial layers, inducing the passage of debris and haematoma from the injury site.

Segmental effects include:

5. reduction in afferent pain transmission,
6. alteration of the axoplasmic flow within the neurons and
7. a facilitation of lymphatic flow.

Systemic effects include:

8. an influence on pain via endogenous opioid formation and,
9. effects on circulating blood as both a messenger transport mechanism and modulation of cells and plasma within circulating blood.

LLLT also produces delayed or latent treatment effects locally and both distally and proximally, such as pain relief mediated through the neural and blood circulatory systems with subsequent autonomic changes. LLLT facilitates repair in damaged tissue through multiple pathways.

**Philip Gabel**  
**University of the Sunshine Coast**

---

*Implementation of the LANCET review protocols for chronic cervico-thoracic pain: a clinical case series*

The use of LLLT for chronic Cervico-thoracic pain was significantly advanced by the 2010 Lancet publication of Chow et al. The summary findings and protocol recommendations are instituted within the clinical setting by therapists with knowledge and skill in the use of LLLT. This three-patient case series of patients with chronic Cervico-thoracic pain

presents their individual progression and management. This is an n=3 study that provides clinical evidence to support the protocols recommended by WALT and the LANCET publication with local dosage at 9-12J cm<sup>2</sup> per point range. By recording the baseline status with pain and functional outcome measures the status and progress of the individual patient can be monitored and measured over time. This provides the three arms of evidence under the internationally recognised definition of Sackett: external research evidence; clinician expertise; and patient values and preferences. This provides a clinical case example that supports the protocols from the systematic review and an example of research made clinical. This interpretation of research findings being moved to the clinical setting is the concept behind systematic review – but their actual implementation action is not often presented. This three-patient case series is an example of how to use the advances in research to assist daily management of patients within the clinical setting.

## Philip Gabel

University of the Sunshine Coast

---

### *A Pilot Study on: Laser for Smoking Cessation and its Effectiveness at Six Months Follow-up*

Smoking Cessation is a much publicised and marketed area for LLLT. It is particularly popular among non-trained or alternative therapy providers with the largest group being franchise operators. The concept is that cravings from nicotine addiction will be reduced by the normalisation of the levels of brain chemicals such as endorphins and neurotransmitters. A pilot study was performed on 20 consecutive self-funded patients, 40% female, age 33+/-9 years, duration of smoking 14+/-7 years range 4-15 years, recruited by advertising or word of mouth. Each participant was provided up to 10 therapy sessions over five weeks, seven over three weeks and an optional weekly session for up to three weeks (average=6+/-2). Treatment included LLLT at sites across the body based upon traditional acupuncture and auricular therapy. Application included a 5x200mW cluster with 30 seconds per site to the trunk and ear ranging from 8-16 sites with a sequential dosage and area increase. Supplementary therapy included a 104 cluster LED, a 500mW diode for acu-points and visual imaging and behaviour modification. All participants were to have completed a pre-treatment checklist of aims, intentions, support individuals and reading the national Quit Smoking pamphlet. At the end of the three-week base treatment cycle 85% had ceased smoking, this remained until the end of the supplementary period at five weeks and reduced to 70% at three months and 65% at six months. Study weaknesses are that reliability was by patient self-report with the three and six months by telephone with anticipation of patients incorrectly responding leaving estimates of true levels of cessation being 50%. LLLT as a component of a multi-modal treatment approach is a viable treatment option for long-term smoking addition with no negative side-effects but requires intense intervention and follow-up.

## Manasi Gaikwad

Your Healthy GP

Co-Authors: Mark Rogers

---

### *Effect of digital infrared thermal imaging and low level laser therapy on chronic lower back pain*

#### **Aim:**

The present paper describes a nonconventional treatment of three patients diagnosed with Lower back pain, using Digital Infrared Thermal Imaging (DITI) and Low Level laser Therapy (LLLT).

#### **Material:**

In Australia 79% adults and 84% of adolescent population experience lower back pain. The National Institute for Health and Clinical Excellence defines lower back pain as soreness with or without stiffness in the lower back area, associated with different structures of the back such as joints, disks and connective tissues. However, it is not always possible to identify the specific cause of pain. DITI and LLLT were used in conjunction for the treatment of these patients. DITI was used to identify the spots of pain to be targeted and LLLT was used for treating the targeted areas of inflammation. Identification of the soft tissue inflammation was done by observing the changes in the skin surface temperature as displayed in DITI. The DITI examination of these patients revealed presence of soft tissue inflammation. The case history of these patients showed the duration of lower back pain to be greater than 6 months. This "spot" of soft tissue injury was then treated using LLLT. LLLT is the application of red or near



infrared radiation was applied on this area of soft tissue injury. On completion of the treatment, second D.I.T.I was performed which revealed substantial reduction in the region of inflamed tissues and pain based on visual analogue scale. This treatment was performed for a period of 4 months. This study has provided an insight into the combined effectiveness of using DITI and LLLT. These two separate modalities act complimentary to each other for diagnosing and treating different pain and inflammatory syndromes. However, further study on large group of subjects is necessary.

**Result:**

Approximately, 70-80% reduction in pain and inflammation was observed.

**Roy George**  
**Griffith University**

---

*Modifying laser-induced shock waves for clinical endodontics*

**Background:**

Explosions and implosions generated by lasers in fluid-filled root canals can create shock waves that cause a shear stress along the root canal walls, which may be sufficient to remove smear layer and biofilm. When used with sodium hypochlorite and EDTA, pulsed lasers could increase the efficiency of debridement and disinfection of the complex root canal anatomy. However, the use of conventional tips with these irrigating solutions poses a risk of driving fluids past the root apex and causing post-operative complications. The purpose of this study was to evaluate the shockwave patterns of a newly patented side-firing honeycomb tip.

**Methodology:**

Clear epoxy resin replicas of single tooth root canals were used to study fluid movement in the root canal from 200-micron diameter plain, tube etched conical tips or honeycomb side-firing tips. A 940nm diode laser was used at 4 watts in continuous mode for 5 seconds. Fluid movements within the canal were recorded using a digital camera attached to a microscope with back lighting. Results: The honeycomb tips generated shockwave directed onto the walls of the root canal. Both the conventional plain fibers and conical tips directed shockwaves primarily in a forward direction, however with the conical tip some waves were also directed onto the walls of the canal apical to the tip.

**Conclusion:**

The use of honeycomb tips may be preferable over conventional and radial firing tips because both the latter propel fluids at high speeds in a forward direction, increasing the risk of fluid being extruded. By spreading energy laterally, the new tip design may help enhance laser-assisted disinfection and debridement with reduced risk of apical extrusion of fluids.

*Disclosure: The authors hold global patent protection on the honeycomb tip technology.*

**Richard Godine**  
**Ruckersville Animal Hospital**

---

*Laser therapy in veterinary applications*

The past ten years has seen a dramatic increase of laser therapy within small animal hospitals. Its proven efficacy with musculoskeletal and dermatologic diseases makes these two systems the vast majority of protocols used and marketed in small animal veterinary medicine. Protocols for treating other body systems are being explored and refined. The most common systems treated at Ruckersville Animal Hospital in order are: musculoskeletal, dermatological, neurological, urinary, digestive, pulmonary, cardiac, and neoplasia. Laser therapy is most often used as an adjunct to traditional therapies and has proven to both increase clinical success rates and shorten treatment times. In other instances, it can be a standalone treatment modality often obviating the need for surgery

or long term potentially harmful drugs. In order to illustrate the reasoning and specific application of laser therapy to veterinary medical conditions, three clinical cases will be reviewed. The first involves a large bull mastiff canine with severe hip dysplasia and bilateral torn cranial cruciate ligaments. A 500mW, 810nm laser probe was used initially and later switched to a cluster 4 x 60mW, 904nm super pulsed laser. A second case involves a poodle with multiple infected bite wounds in which 660nm and 840nm super luminous diode arrays were used along with an 830nm, 180mW laser diode probe. The last clinical case is an older canine with severe dementia. This patient's brain was treated with a 4 x 500mW, 810nm, cluster laser probe. Each clinical case demonstrates common clinical presentations within small animal veterinary medicine as well as the uniqueness of selecting treatment protocols for patients covered in hair, prone to wiggle, and varying markedly in size and colour.

## **Bruce Griffiths**

**Princess Alexandra Hospital**

---

### *Legislation & Compliance in Queensland – Class 4 lasers*

This presentation will examine firstly the Legislation:

- History
- Steps for Acquiring a Class 4 Laser
- Application for Approval (ATA)

The second part of the presentation will examine issues of Compliance, specifically:

- Interpretation
- HR006 Standard for Class 4 lasers used to carry out cosmetic or health related procedures on human beings
- PR008 Standard for premises at which Class 4 lasers are used to carry out cosmetic or health related procedures

## **Michael Hamblin**

**Harvard Medical School**

---

Transcranial low level laser (light) therapy: mechanisms and application to traumatic brain injury and beyond  
Low-level laser (or light) therapy (LLLT) is attracting growing interest to treat both stroke and traumatic brain injury (TBI). Less well-developed applications include neurodegenerative diseases like Alzheimer's and psychiatric diseases such as depression. The fact that near-infrared light can penetrate through the scalp and skull into the brain allows non-invasive treatment to be carried out with a low likelihood of treatment-related adverse events. It is proposed that red and NIR light is absorbed by chromophores in the mitochondria of cells (which are particularly abundant in cortical neurons) leading to changes in gene transcription and up-regulation of proteins involved in cell survival, antioxidant production, collagen synthesis, reduction of chronic inflammation and cell migration and proliferation. We developed two different models of TBI in mice; a closed head weight drop and an open skull controlled cortical impact (CCI). Transcranial laser therapy consisting of a single exposure 4-hours post TBI to 36J/cm<sup>2</sup> of various lasers was delivered to the closed head model. 810nm or 660nm laser significantly improved neurological severity score in TBI up to 4-weeks post TBI. Laser therapy at 730nm or 980nm was ineffective. We then examined the effect of 0, 1, 3, and 14 daily 810nm laser treatments in the CCI model. 1 laser Tx gave a significant improvement while 3 laser Tx was even better. Surprisingly 14 laser Tx was no better than no treatment. Histological studies at necropsy suggested that the cortical lesion was repaired by neural progenitor (stem) cells from the subgranular layer of the dentate gyrus of the hippocampus and the subventricular zone of the lateral ventricle, possibly stimulated by the laser. Brain derived neurotrophic factor (BDNF) was increased in the hippocampus and double-cortin and TUJ-1 which are markers of migrating neuroprogenitor cells were up-regulated. These data suggest that transcranial laser therapy is a promising treatment for acute (and chronic TBI) and may have much wider applications to neurodegenerative and psychiatric diseases. The lack of side-effects and paucity of alternative treatments for brain diseases encourages early clinical trials.





## Ron Hirschberg

**DVM, Boston USA**

---

### *Veterinary Case Presentations: Why I can't practice without LLLT*

For several decades the treatment for most non surgical musculoskeletal disorders and inflammatory diseases has been steroidal and non-steroidal anti-inflammatory drugs (NSAIDs). Although initially effective in some cases, the short and long term side effects often render this therapy unacceptable. In 2007 we instituted the use of Low Level Laser Therapy (LLLT) in our veterinary practice. It rapidly became the primary treatment option for non surgical musculoskeletal conditions as well as in some cases which previously were considered surgical. During the past five years our use of photobiomodulation has expanded to include treatment of osteoarthritis, degenerative disc disease, acute trauma both musculoskeletal and neurologic, corneal diseases, non healing wounds and a multitude of inflammatory conditions. Our client's acceptance and patient's response to this modality has been enthusiastic. This presentation will briefly review several cases which typify the use of LLLT in our veterinary practice. In addition to case presentations time will be provided to address questions regarding treatment protocols as well as the fiscal considerations of utilizing photobiomodulation in a busy clinical setting.

## Lars Hode

**Swedish Laser-Medical Society**

---

### *The DOSE: a minute to learn, a lifetime to master*

Laser therapy has been known for more than 40 years and it is well known that different parameters influence the result. Of all the known parameters, such as wavelength, intensity, exposure time, polarization, pulsing etc, the dose is the most difficult to quantify. Dose in general means amount, and in this case it refers to the amount of light (photons), or the amount of light energy. At a quick glance it sounds simple: a number of joules. This dose may in turn be delivered to a point (what is the size of a point?), or be evenly distributed over a surface, in which case we have a number of joules per point or per  $\text{cm}^2$ . But how do we define the dose if the light is not evenly distributed? If we deliver a joule in a point on a mouse paw, or in a point on the knee of an adult person, the result will probably be very different. How should we view the given energy in relation to the body mass of the treated object? Moreover, in many cases the target tissue is located at a certain depth into the body, and yet we usually administer the light to the surface of the overlying skin. This means that we chart the dose in two dimensions, but deliver the light in three dimensions inside the tissue under the skin, i.e. joules per  $\text{cm}^2$  is converted to joules per  $\text{cm}^3$  with a specific value in every point reached by the light. How do we account for that? Then we have the systemic effects: what dose do we want to give to optimise them? And how? Finally, how do we account for other factors that may influence the dose-dependent outcome, such as the effects of moving fluids? In the light of the questions above it is evident that most scientific reports specify the dose very poorly, usually in such a rudimentary way that it is impossible to repeat a study (for example, "we gave 4 joules/ $\text{cm}^2$ " without any further specification). There is a lack of consensus about the definition of dose in the scientific community that we need to address.

## Lars Hode

**Swedish Laser-Medical Society**  
**Co-Authors: Tomas Hode**

---

### *Coherence – do we need it?*

An alternative title to this presentation could be "the never ending story". By 1985 the Hungarian, Pal Greguss, had claimed that coherence is lost when laser light (= coherent light) is scattered in tissue; others have followed since. In a well-known presentation in Los Angeles in 1991, Lars Hode demonstrated that coherence is not lost after laser light penetration of a 1cm thick slab of raw meat. Furthermore, the development of methods such as Laser Doppler Velocimetry, Optical Coherence Tomography and Laser speckle contrast imaging for measurement of blood flow,

would not work if coherence was lost in living tissue. In fact, it is very well known that coherent light forms three dimensional speckle patterns in biological tissue, that is often referred to as bio-speckles. However, we also know that other light sources can be used to achieve photobiomodulation; but do we get better effects with laser? If that is the case, then how, and why? We will try to illuminate the role of speckles in LLLT in a coherent manner.

## Loh Hong Sai

---

### *Effects of low level laser therapy on nerve remyelination – an animal study*

The aim of the study was to investigate the myelination effects of low level laser therapy (LLLT) following demyelination by topical application of lysophosphatidyl choline (LPC) in a rat model. These animals were randomly divided into two groups following topical application of LPC on rat's sciatic nerve. One group was delivered LLLT (40J) while the other group received no laser therapy and served as the control. The nerve tissues were harvested on the 7th, 10th, 14th, 18th, 21st and 28th days. The axons were classified into 2 groups according to their sizes. Myelin thickness and g-ratio (axon : axon + myelin) were calculated. There was a significant increase in the myelin thickness for both the smaller ( $p=0.000$ ) and the larger axons ( $p=0.005$ ). Consequentially, the g-ratio of the smaller axons was significantly lowered ( $p=0.000$ ), as well as for the larger axonal group ( $p=0.001$ ). On the 21st and the 28th day, there were no significant differences between the laser and the non-laser groups for g-ratio as well as myelin thickness. LLLT application seemed to significantly increase myelin thickness along with significant reduction in their g-ratio as compared to the controls especially following the initial phase of demyelination. Therefore, it appeared to play a role in remyelination of a demyelinated nerve.

## Nicolette Houreld

**University of Johannesburg**

---

### *Laser irradiation in the visible wavelength stimulates wound healing in vitro*

Since the invention of the laser, its application in the health sector has been studied in an attempt to discover effective alternative treatments. Low intensity laser irradiation has been applied to stimulate healing in a variety of conditions, such as diabetes. Although this therapy is in use worldwide, the full cellular molecular mechanisms of action are not fully understood. This study aims to determine the biochemical and molecular responses to low intensity laser irradiation, in the visible red spectrum, in an in vitro wound model. Various cell culture models, such as wounded, diabetic wounded and hypoxic were used. Models were exposed to visible red laser light (632.8, 636 or 660nm) at a fluence of  $5\text{J}/\text{cm}^2$ . Post-irradiation, the effect on cell migration, cell survival, proliferation, cytotoxicity, mitochondrial responses, nitric oxide, secondary messengers, DNA damage, pro-inflammatory cytokines, and collagen were studied. Laser irradiation has shown to have a positive effect on stressed cells in vitro. There is an increase in migration, survival and proliferation, mitochondrial activity, nitric oxide, secondary messengers and collagen. A decrease in cytotoxicity, DNA damage and pro-inflammatory cytokines was also seen. LLLT offers an alternative wound healing therapy. At a biochemical level there is a positive effect on cells, with stressed cells being pushed into cell survival pathways.

## Natalia Iosimuta

**Federal University of Sao Carlos**

---

### *Low level laser therapy (660nm) alters expression of genes during muscle regeneration in rats.*

Muscle trauma and muscle injuries often occur in professional and recreational sports and daily activities. Nevertheless, depending on the extent of the lesion, the regenerating process is considered very slow and some injuries affect muscle functioning, leading to atrophy, contracture, pain and increased likelihood of re-injury. The objective of this study was to evaluate the action of 660nm low level laser therapy (LLLT), used in two different fluencies ( $10$  and  $50\text{J}/\text{cm}^2$ ) on muscle healing, through mRNA, MyoD, myogenin, VEGF and COX-2 expression. Sixty three rats were distributed into 3 groups: control group (injured animals untreated); laser treated group having  $10\text{J}/\text{cm}^2$ , and laser treated group having  $50\text{J}/\text{cm}^2$ . Each group was further divided into 3 subgroups ( $n=7$ ), a group



was sacrificed on days 7, 14 and 21 post-injury, respectively. Histopathological findings revealed mild degenerative changes of muscle tissue in the LLLT exposed group to the higher dose, when compared to the other groups at 7 days post-surgery. On the last periods, the animals irradiated with 50J/cm<sup>2</sup> also showed minor inflammatory cells and more organized fiber muscle than the control group and the irradiated group having 10J/cm<sup>2</sup>. Regarding gene expression, the LLLT with the high dose increased MyoD, Myogenin and VEGF levels after 14 and 21 days post-injury, and decreased COX-2 expression during all periods of treatment. These results showed the LLLT was able to influence molecular responses during the treatment of injured muscle, accelerating the muscle fibre formation.

### **Insoo Jang MD**

**Dept of Internal Medicine, College of Korean Medicine, Woosuk University**  
**Department of Internal Medicine, Woosuk University Hospital of Korean Medicine,**  
**Associate Professor, College of Korean Medicine, Woosuk University, Jeonbuk, South Korea**  
**Chair of Korean Medicine Association for Laser Therapy**

---

Insoo Jang MD (Korean Medicine) PhD is an Associate Professor of College of Korean Medicine, at Woosuk University, Jeonbuk, South Korea and working at the Department of Internal Medicine, Woosuk University Hospital of Korean Medicine since 2001. He graduated from premedical course and college of Korean Medicine at Woosuk University, and his PhD from Kyunghee University in 2002, was entitled: Study on the central neural pathway of the heart, Neikuan (EH-6) and Shenmen(He-7) with neural tracer in rats.

He is a specialist in internal medicine registered in the Ministry of Health and Welfare, Korea, and worked as a military doctor (Medical officer, First Lieutenant), Black Panther Air-Borne Brigade, Korean Army Special Force (1996-1999). Dr Insoo Jang was a visiting scholar in the University of North Carolina in Chapel Hill, School of Medicine, Department of Physical Medicine and Rehabilitation. NC, USA (2007-2008).

He is on the editorial board of three scientific journals (in Korean) and also working as a reviewer for the peer-reviewed journals (indexed by PubMed): Complementary Therapies in Medicine, Journal of Alternative and Complementary Medicine, Evidence Based Complementary and Alternative Medicine, BMC Complementary and Alternative Medicine, Journal of Acupuncture and Meridian Studies, and others. He is the Chair of Korean Medicine Association for Laser Therapy and, his research keywords are laser acupuncture, LLLT, the methodology of clinical research, and neurology.

### **Jon Joensen**

**Bergen University College**

---

#### *Timing Low Level Laser Therapy in rat Achilles Tendon Injury*

##### **Abstract:**

The aim of this controlled animal study was to investigate the effect of low level laser therapy (LLLT) after injury to the Achilles tendon. Thirty-two Sprague Dawley male rats were divided in four groups. The right Achilles tendons were injured by blunt trauma using a mini guillotine. An hour after injury three groups received active LLLT (λ=904 nm, 60mW mean output power, 0.158W/cm<sup>2</sup>) and the fourth group received placebo LLLT. Group 1 received 1J, Group 2 received 3J, Group 3 received 3J. The same injury and LLLT procedures were then repeated on the same tendon the next day. On day 3 ultrasonographic images were then taken in order to measure right and left Achilles tendon thickness. All analyses were performed by blinded observers. There was a significant increase in tendon thickness in the active LLLT group-2 when compared with the placebo group (p<0.05) and there were no significant differences between the placebo and uninjured left tendons. Laser irradiation at 0.158W/cm<sup>2</sup> for 50 seconds (3J) administered within the first hour after a blunt trauma tendon injury, repeated after 15 hours, appears to increase oedema in rat Achilles measured 23 hours after LLLT. The guillotine blunt trauma model seems suitable for inflicting tendon injury and measuring treatment effects in oedema by ultrasonography and UTS. The study on group 1 and 3 is ongoing, (and will be added before the conference).

*Keywords: LLLT, timing LLLT intervention, acute injury, rats Achilles, ultrasonographic imaging, oedema.*

## Jon Joensen

Bergen University College

---

*Skin penetration from pulsed-, continuous- and superpulsed low-level lasers*

### Abstract:

The aim of this study was to investigate the level and profile of energy penetrating skin during 150 seconds of LLLT irradiation from chopped pulsed-, continuous- and superpulsed lasers.

### Method:

Sixty, fresh harvested, skin flaps overlaying rat hind legs were irradiated by three modes (pulsed,  $\lambda=810\text{nm}$ , 200mW MOP; continuous,  $\lambda=810\text{nm}$ , 200mW MOP; and superpulsed,  $\lambda=904\text{nm}$ , 60mW MOP). Irradiation was done with two procedures: 1) the laser probe in skin contact; and 2) the laser probe not in skin contact. The amount of energy penetrating skin was measured by an optic power-meter.

### Results:

During 150 seconds of irradiation both chopped pulsed- and continuous mode had a constant level of energy penetrating the skin. 20% of MOP penetrated the skin from these irradiation modes. The level of energy penetrating skin from the superpulsed irradiation mode was significant ( $p < 0.01$ ) higher than from chopped pulsed- and continuous modes during the whole sequence of irradiation. The superpulsed irradiation mode skin penetration profile during irradiation time also differs from the other modes. The percentage of MOP penetrating skin from the superpulsed mode increased from more than 30% to more than 50% of MOP during 150 seconds of irradiation. Irradiation with the laser probe in skin contact versus not in skin contact resulted in a small change in skin penetration for both lasers. The level of energy penetrating skin changed 2-4%. The change is mainly attributed to the physical shape of the laser probe tips.

### Ethical approval:

This study was approved by the local animal committee at University of Bergen, Norway (Appl. No. 20102676).

*Keyword: LLLT, irradiation mode, chopped pulsed, continuous, superpulsed, irradiation time, skin penetration.*

## Milad Karamlou

Dentist

Co-Authors: Reza Fekrazad, Katayoun Kalhori

---

*The Effect of GaAlAs laser on chemical and thermal wounds healing*

### Introduction:

There is a lack of information about low level laser therapy in chemical and thermal burns. This study was designed to evaluate the clinical and pathologic effects of low level GaAlAs laser on chemical and thermal wounds healing in rabbits.

### Method:

0 male rabbits were divided in two equal groups. Six  $1\text{cm}^2$  wounds were induced using HCL (37%), sulphoric acid (99%) and dry heat (1000C) in two parallel rows on the back of each rabbit. GaAlAs laser treatment was started on day zero, and also given on days one, two, three, four, six, eight, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 and 30. Laser therapy was applied in Group one on right hand side row of wounds, and in Group two it was applied on the left hand side. Five rabbits from Group one and five from Group two were sacrificed on day 14. The rest of them were sacrificed on day 30. The wounds were surgically removed to the depth of the underlying muscles. All of the specimens were evaluated pathologically to compare the effect of laser on the different wounds, and to compare the active with the control groups.



### Results:

We evaluated a total of 120 wounds; of the wounds having laser 56 (93.3%) responded to therapy both clinically and pathologically, while in the control group 45 wounds (75%). The difference between two groups was statistically significant ( $P = 0.001$ ). Tissue necrosis was significantly greater in control group.

### Conclusions:

Our study showed that laser therapy was an effective method in thermal and chemical wound healing.

### Aletta Karsten

National Laser Centre, CSIR

---

#### *Application of computer modelling to predict the effect of melanin concentration on treatment time*

The South African population consists of individuals of European, Asian and African descent. This poses a problem when treating patients with lasers due to a difference in melanin content and the associated absorption of light in the epidermal layer for the different individuals. Computer models can be used efficiently to predict the fluence transmitted through specified skin layers. A computer model (consisting of different skin layers) was developed in the ASAP software environment. Very high epidermal absorption coefficients (up to  $4\text{mm}^{-1}$ ) were measured for some individuals. Due to these high values, the diffuse approximation (which requires the absorption coefficient to be much smaller than the reduced scattering coefficient, typically  $2\text{-}4\text{mm}^{-1}$ ) was not applicable. Monte Carlo ray tracing was used to solve the radiative transport equation. Australia and South Africa are the countries with the highest incidence of skin cancer in the world. Photodynamic Therapy (PDT) is one of the treatments currently under investigation to treat skin cancer, specifically basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). In the model both an epidermal and a dermal skin layers were used with a tumour embedded in the dermis. The fluence reaching the tumour (at a depth of  $200\mu\text{m}$  below the surface) was calculated for different absorption coefficients (present in the South African population). For an epidermal thickness of  $70\mu\text{m}$  with an absorption coefficient of  $4\text{mm}^{-1}$  only 30 % of incident light reached the tumour as opposed to 51% for a very low absorption coefficient ( $0.002\text{mm}^{-1}$ ). For effective treatment a dose of  $4.5\text{J}/\text{cm}^2$  is required. For a constant laser power density of  $50\text{mW}/\text{cm}^2$  (at the skin surface) the higher absorbing skin needs to be treated for 399s and the low absorbing skin needs to be treated for only 235s.

### Tiina Karu

Laser Technology Research Centre of Russian Academy of Science

---

#### *Cellular mechanisms of photobiomodulation behind the clinical findings*

This presentation reviews the current knowledge in photobiology and photomedicine about the influence of monochromatic, quasimonochromatic and broad-band radiation of red-to-near infrared (IR-A) part on solar spectrum upon mammalian cells. The role of cytochrome c oxidase as the photoacceptor and photosignal transducer is underlined and its photosensitivity at certain circumstances is explained. Cytochrome c oxidase is the terminal enzyme of the respiratory chain in eukaryotic cells mediating the transfer of electrons from cytochrome c to molecular oxygen. It is considered as the photoacceptor as well as photosignal transducer in the region of visible and IR-A region. This reactivity is due to four redox active metal centers: the binuclear CuA, CuB, heme a and heme a<sup>3</sup>, all of which have absorbance in the red to IR-A range. Besides the photobiomodulation, the radiation in red and IR-A region is protective against harmful effects of and UV radiation and reverses the toxic effects of neuro- and retinotoxins. Last years, a long series of discoveries has demonstrated that ATP (which extrasynthesis in the respiratory chain occurs due to the irradiation) is not only an energy currency inside cells, but it is also a critical signaling molecule that allows cells and tissues throughout the body to communicate with one another. This new aspect of ATP as an intercellular signaling molecule allows broadening the understanding of universality phenomenon of photosensitivity of cytochrome c oxidase.



## ByungKuk Kim

Department of oral medicine, School of dentistry, Chonnam National University, Korea

Co-Authors: Wonbong Lim, Jisun Kim, SangWoo Kim, Sandeep Karna, HongRan Choi, HyunRok Cha, EunSeo Choi, OkJoon Kim

---

### *Effect of 635 nm irradiation on high glucose-boosted inflammatory responses in LPS-induced MC3T3-E1 cells*

Hyperglycemia occurs in patients with poorly controlled diabetes mellitus, and contributes to bone resorption and increased susceptibility to bacterial infections. Hyperglycemia can incite low-grade inflammation that can contribute to the resorption of bone, especially the periodontal bone. The increased susceptibility to periodontal infections can contribute to bone resorption through the activation of osteoclasts. In this study, the osteoblastic clonal cell line, MC3T3-E1, was used in an in vitro model of hyperglycemia and lipopolysaccharide-induced reactive oxygen species generation, to determine the potential anti-inflammatory effect of 635 nm light-emitting-diode (LED) irradiation OR whether 635nm light-emitting-diode (LED) irradiation can be a potential anti-inflammatory treatment. LED irradiation of MC3T3-E1 cells stimulated with LPS in a high glucose-containing medium decreased the level of cyclooxygenase gene and protein expression and reduced the level of prostaglandin E2 expression by decreasing the amount of reactive oxygen species generation. LED irradiation also inhibited the osteoclastogenesis in MC3T3-E1 cells by regulating the receptor activator of nuclear factor kappa B ligand (RANKL) and osteoprotegerin. These findings reveal the mechanisms which are important in the pathogenesis of diabetic periodontitis and highlight the beneficial effects of 635nm LED irradiation in reducing the adverse effects of diabetic periodontitis.

## JiSun Kim

Department of Oral Pathology, School of Dentistry, Chonnam National University, Korea

Co-Authors: Wonbong Lim, SangWoo Kim, Sandeep Karna, ByungKuk Kim, HongRan Choi, OkJoon Kim

---

### *Down-regulation of heat shock protein 27 induced resistance to photodynamic therapy in oral cancer cells*

Photodynamic therapy (PDT) of cells is a new treatment modality involving selective delivery of a photosensitive dye into target cells, followed by visible light irradiation. PDT induces cell death by excessive ROS generation. The effects of multiple photosensitizers were due to the difference in cell types involving sensitizer-specific protein changes linked to resistance. HSP27 is regulated in response to stress and is associated with apoptotic processes. The effects of HSP27 on PDT resistance are controversial and unclear. The purpose of this study was to investigate the role of HSP27 down-regulation in the PDT-induced cells and HSP27 regulation in the resistance to PDT. KB cells transfected with HSP27 siRNA were exposed to hematoporphyrin followed by irradiation at 635nm at an energy density of 4.5 mW/cm<sup>2</sup>. After irradiation, the effects on HSP27 down-regulation were assessed by MTT assay, flow cytometry, confocal analysis, western blotting and caspase activity. The results of this study showed that down-regulation of HSP27 restored cell survival in HP-PDT-induced apoptotic KB cells. HSP27 down-regulation attenuated PDT-induced apoptosis through the caspase-mediated pathway in KB cells. Also, HSP27 silencing regulated Bax, Bcl-2 and PARP protein expression in PDT-induced cells. Therefore, HSP27 down-regulation confers resistance to PDT through interruption of apoptotic protein activity in PDT-induced cell death. HSP27 might contribute to regulating PDT-induced apoptosis in PDT-resistant cells.

## OkJoon Kim

Department of Oral Pathology, School of Dentistry, Chonnam National University, Korea

Co-Authors: Jisun Kim, WonBong Lim, Sangwoo Kim, Sandeep Karna, Hongran Choi

---

### *PDT-resistance of Autophagic cell death by HSP27 down regulation in oral cancer cells*

Photodynamic therapy is anticancer treatment, which induced excessive ROS generation after photosensitizer treatments following specific wavelength irradiation. PDT induced various signal transduction cascade such as apoptosis and necrosis. In previous study, we reported that hematoporphyrin (HP) - PDT induced mitochondria-mediated apoptosis by



caspase activation in oral cancer cells. In this study, we investigated that HSP27 regulated autophagy and apoptosis signaling cascades in HP-PDT induced oral cancer cells. By confocal microscopy, western blot and siRNA transfection, autophagy and apoptosis were observed in HP-PDT induced oral cancer cells studied. In low doses, PDT induced autophagy through mTOR, ATG5 and LC3. However, PDT induced apoptosis through caspase activation and PARP-1 in high doses. Moreover, autophagy inhibitor was protected cells against HP-PDT induced cell death, but not by caspase inhibitor. Down regulation of HSP27 has attenuated LC3 activation in HP-PDT treatments. Therefore, we reported this study that HSP27 might play an important role through autophagy signaling cascade in HP-PDT induced oral cancer cells.

### **Slava Kim**

**Meditech International Inc.**

**Co-Authors: Fred Kahn, Alana Ross, Fernanda Saraga**

---

#### *Managing complex and recalcitrant wounds with low-intensity laser therapy*

##### **Background:**

Complex wounds are some of the most difficult medical conditions to treat despite many advances in conventional wound care. Whether they are aggravated by chronic illnesses or complicated by poor compliance and ineffective wound care practice, many patients with such wounds are long-suffering. Low-Intensity Laser Therapy (LILT) is not only known to provide significant success in decreasing chronic inflammation, but has also been documented to enhance wound healing and tissue repair.

##### **Purpose:**

To evaluate and document the progress of patients with various intractable wounds previously treated with conventional wound care, including topical ointments, antibiotics and bandages. Measures included wound area, rate of healing, and pain score.

##### **Methods:**

Eight patients with vascular/diabetic ulcers of the lower extremity were evaluated and photographed before, during and after their final course of Laser Therapy. The protocol consisted of the application of a red (660nm) light-emitting diode (LED) array (750mW, 10mW/cm<sup>2</sup>), infrared (840nm) LED array (1500mW, 20mW/cm<sup>2</sup>), red laser (660nm, 75mW, 750mW/cm<sup>2</sup>) and infrared laser (830nm, 180mW, 1800mW/cm<sup>2</sup>).

##### **Results:**

Wounds that were unresponsive to prolonged periods of conventional wound care demonstrated a significant response to Laser Therapy in terms of neovascularisation, collagen formation and re-epithelialisation from wound edges. Reduction in pain score and wound area was found to be proportional to frequency of treatments. Compliance with the treatment programme resulted in a rapid reduction in pain and wound dimensions.

##### **Conclusion:**

LILT is a therapeutic approach that not only expedites the inflammatory process, but more importantly enhances tissue healing, even with chronic and intractable wounds.

### **Slava Kim**

**Meditech International Inc.**

**Co-Authors: Fred Kahn, Alana Ross, Fernanda Saraga**

---

#### *Application of laser therapy for dermatological conditions*

##### **Background:**

Dermatological conditions such as Herpes Zoster, Eczema, Psoriasis and Dermatitis are often difficult to treat with conventional pharmaceuticals and topical ointments. Along with the social stigma associated with these conditions, patients often feel prolonged discomfort, which affects their daily activities.

**Purpose:**

To evaluate and document the progress of patients with various dermatological conditions. Criteria regarding progress include pain levels and physical appearance of the lesion.

**Methods:**

Patients suffering from Herpes Zoster (12 patients), Eczema (6 patients), Psoriasis (5 patients) and Dermatitis (3 patients) were evaluated and photographed before, during and after the final course of Laser Therapy. The protocol consisted of the application of a red (660nm) light-emitting diode (LED) array (750mW, 10mW/cm<sup>2</sup>), infrared (840nm) LED array (1500mW, 20mW/cm<sup>2</sup>), red laser (660nm, 75mW, 750mW/cm<sup>2</sup>) and infrared laser (830nm, 180mW, 1800mW/cm<sup>2</sup>). Patients were initially treated on consecutive days varying from two to six days. Thereafter they were treated two to three times per week until the condition was completely resolved.

**Results:**

The number of treatments ranged from two to fourteen with an average of eight treatments to resolve the condition. A positive change in the physical appearance of the dermal condition as well as a reduction in discomfort or pain was achieved in as little as two treatments in some cases. Chronic conditions that failed to respond to conventional treatments also showed a significant improvement in the appearance after two to three treatments.

**Conclusion:**

Laser Therapy is an effective therapeutic approach for the treatment of dermatological conditions, in particular with respect to those that have not responded to conventional treatments.

**Liisa Laakso**

**School of Rehabilitation Sciences, Griffith University, Australia**

---

*Assessing clinical responsiveness to LLLT***Background:**

Kert and Rose (1989) were the first to publish a comprehensive work on the 'treatment reaction', side effects, harmful effects and contraindications to low level laser therapy (LLLT). Knowledge regarding the clinical outcomes of LLLT has exponentially increased since that time yet a standardised, evidence-based approach to assessing clinical responsiveness to LLLT remains elusive.

**Aim:**

This paper will propose a standardised, evidence-based approach to assessing clinical responsiveness to the safe application of LLLT.

**Method:**

A system of clinical assessment and treatment approach incorporating an understanding of signs and symptoms typically seen in pain conditions and open wounds, typical stimulation effects of and treatment reactions to LLLT, and knowledge of treatment progression, as well as precautions and contraindications is outlined.

**Results:**

The author's work has demonstrated that: (1) the application of a low, challenge dose to LLLT-naïve individuals may assist in avoiding unpleasant treatment reactions; (2) evidence-based doses may result in sub-clinical responses occurring within minutes of the application of LLLT; and (3) clinical responses should be apparent within 3-6 treatments if appropriate dosing is utilised.

**Conclusion:**

When LLLT is administered according to the standardised, evidence-based approach outlined, it is possible to evaluate clinical responsiveness within minutes for pain symptoms and within one or two treatments for open, soft tissue wounds.



## Antonio Lauto

University Western Sydney

Co-Authors: Matt Barton, David Mahns, John Morley, Damia Mawad, Marcus Stoodley

---

*In vivo median nerve anastomosis using chitosan-rose bengal adhesives*

### Objective:

The anastomosis of peripheral nerves is potentially complicated due to foreign-body reactions elicited by sutures. In this study, a photochemically laser-activated adhesive was used to perform sutureless anastomoses of median nerves in rats. Method. A novel adhesive, based on chitosan and including the dye rose bengal, was fabricated in thin strips. Its adhesive strength was tested acutely by bonding the strips (surface area  $\sim 20\text{mm}^2$ , thickness  $\sim 15\mu\text{m}$ ) onto bisected median nerves with low fluence ( $\sim 110\text{J}/\text{cm}^2$ ), using a fibre-coupled diode laser (532nm) in continuous wave mode. The chitosan adhesive was then used to perform in vivo sutureless anastomosis of median nerves. Rats were sacrificed after 1 week to assess nerve continuity and repair strength. As a control, adhesive strips were also bonded in vivo onto intact median nerves to evaluate histologically possible thermal damage induced by the laser 1 week after the operation.

### Results:

The acute bonding strength was  $25 \pm 9\text{kPa}$  (mean  $\pm$  SD,  $n=15$ ). This strength dropped to  $2 \pm 1\text{kPa}$  ( $n=15$ ) when the laser was not applied to the adhesive (control). The in vivo nerve anastomoses were intact 1 week after surgery ( $n=9$ ) and the adhesive repair strength was  $15 \pm 6\text{kPa}$ . No neuroma was observed in any of the repaired nerves. Histological assessment (luxol fast blue,  $n=6$ ) showed that the laser irradiated adhesive did not affect the morphology of myelinated axons beneath it.

### Conclusions:

The laser adhesive procedure was shown to be effective for nerve anastomosis, preserving myelinated axons. The photochemical activation of the adhesive prevented the production of excessive heat and nerve thermal damage. Long-term nerve anastomoses are currently under study to evaluate nerve regeneration 3 months after the rose bengal-chitosan adhesive procedure.

## Ernesto Cesar Leal Junior

Nove de Julho University (UNINOVE)

---

*Light emitting diode therapy (LEDT) and cryotherapy in skeletal muscle recovery after eccentric exercise*

In recent years phototherapy has become a promising tool in improvement of skeletal muscle recovery after exercise. However, few studies have compared phototherapy with other modalities commonly used to this aim. Additionally, to the best of our knowledge no study has combined phototherapy with any other therapeutic modality. We aimed to analyze effects of light emitting diode therapy (LEDT) and cryotherapy when used as single or combined therapeutic modality after eccentric exercise. A randomized double-blind placebo-controlled trial was performed with 50 healthy male volunteers (10 per group). Volunteers signed a written declaration of informed consent and performed a standardized protocol of eccentric exercise for elbow flexors in isokinetic dynamometer. Immediately after exercise volunteers were treated with placebo LEDT, cryotherapy+placebo LEDT, LEDT, cryotherapy+LEDT or LEDT+cryotherapy. Cryotherapy was performed using a pack with water and ice ( $10^\circ\text{C}$ ) for 20 minutes, and LEDT was performed using a multi-diode cluster probe (34 diodes, 660nm, 10mW; and 35 diodes, 850nm, 30mW) with the following parameters: continuous output,  $0.05\text{W}/\text{cm}^2$  (660nm) and  $0.15\text{W}/\text{cm}^2$  (850nm),  $1.5\text{J}/\text{cm}^2$  (660nm) and  $4.5\text{J}/\text{cm}^2$  (850nm), 41.7J (0.3J from each red LED, 0.9J from each infrared LED), treatment time of 30 seconds in a single point of biceps brachii muscle. Delayed onset muscle soreness (DOMS) and maximal voluntary contraction (MVC) assessments were performed before, immediately after (between exercise and treatments), one, 24, 48 and 72 hours after exercise. Regarding MVC and DOMS, treatment with LEDT, LEDT+cryotherapy and cryotherapy+LEDT were significantly better ( $p<0.05$ ) than placebo LEDT and cryotherapy+placebo LEDT at one, 24, 48 and 72 hours after exercise. This lead us to believe that positive effects are

due to LEDT and not necessarily to combination of LEDT with cryotherapy, since cryotherapy (as single treatment) did not improve outcomes tested. We conclude that LEDT is more efficient in improvement of skeletal muscle recovery after eccentric exercise, and that a combination with cryotherapy does not change the efficacy of LEDT.

## **Ann Liebert**

### **Artarmon Physiotherapy**

---

#### *The Role Of Channelopathies in Pain and the Implications for Laser Treatment*

##### **Purpose:**

To review the most recent, basic research into the role of nerve channelopathies in chronic pain conditions. To discuss implications for the role of laser mechanisms in the modulation of both peripheral and central nervous systems for these chronic conditions. The aim of laser treatment would be to improve clinical outcomes for previously unresponsive conditions.

##### **Relevance:**

Chronic pain conditions represent a huge burden of society in terms of loss of income, loss of productivity and the negative impact on daily life activities. Several common pain conditions have been recently found to have channelopathies as either a primary pathogenesis or comorbidity. Examples of these are Headache including Migraine with Aura (Lafreniere, RG et al. 2010), Familial Hemiplegic Migraine Type I + II (calcium and sodium channelopathies) (Cregg, 2010), Polymodal Pain Disorders (Alloui, A, et al. 2006), Irritable Bowel Syndrome and Erythralgia (Sodium Channelopathy) (Cregg, 2010). These conditions have often been shown to have poor clinical outcomes with current management the pathophysiology of these conditions could be postulated to be potentially modulated by mechanisms of laser that have been explored in current basic research. The implications of the current research into modulation of sensory motor, and second- and third-order neurones, will be discussed with reference to their relevance in channelopathy pain. This includes review into the mechanisms of laser modulation of nerve excitability (Chow, 2011) neuroendocrine affects (Shimoyama, 1996) and central nervous systems modulation via signalling pathways in the CNS (Hamblin, 2006). The expression of channelopathy in Eryomyelgia is an example of pain that can be modulated by other compensatory factors. The understanding of pain channelopathies and their relevance to pain pathways is more broadly important in the treatment of chronic pain. Ion channel dysfunction has been linked to chronic pain evoked by physical insults in current research in human and transgenic animals and insights into these conditions will be discussed in this review paper.

## **Ann Liebert**

### **University of Sydney, Discipline of Physiotherapy Sydney Australia**

#### **Co-Authors: Gordon Waddington, Roberta Chow, Roger Adams**

---

#### *Quantification of the Absorption of Low-Level 904 nm Laser as a Function of Skin Colour*

##### **Purpose:**

Is to investigate the response of variations in skin pigment in the transmission of pulsed low level laser. The aim would be to measure the absorption of low power laser light through the skin of the thenar web and cheek in people with different skin pigment types. Relevance: Low level laser is an effective treatment for relief of inflammation, tissue repair and pain and has been extensively used in various clinical settings. The effect of laser is dose dependant and there are a number of identified factors that can affect the laser dose.

Skin types vary widely among human communities. With the purpose of enabling clinicians to adjust dose in relation to skin type, the Fitzpatrick Skin Typing scale was developed, in this case the ultraviolet A dose for the treatment of psoriasis [1]. One study to date has considered the role of skin colour. Nussbaum [2] investigated the transmission of LED in the red light and infrared spectrum in relation to increasing darkness of skin pigmentation, and found that with increasing skin darkness the transmission of red light laser was significantly diminished. However, with clinical laser 904nm pulsed laser is the most commonly-used instrument frequency for depth





penetration, used to minimise effects of tissue heating [3]. Thus in order to inform treatment dose for individuals with differing amounts of skin pigmentation there is a need for research with transmission of pulsed low-level laser. To quantify the effect of skin colour on absorption of pulsed 904nm low-level laser, an output meter was used to measure transmission of the laser through the thenar web and cheek pad. Ten subjects were chosen with skin colour representing a range of values on the Fitzpatrick scale of skin darkness. Thickness of the thenar web was measured with a micrometer so that the effect of tissue thickness could be controlled for in examination of the relationship between laser transmission and skin pigmentation. Laser transmission was found to significantly decrease with increasing Fitzpatrick level of skin darkness at the thenar web. Over the range of Fitzpatrick scale values employed, from 2 to 6, there was a 24% decrease in energy transmission. The resulting equation shows that for each Fitzpatrick scale point of skin pigmentation after a value of 2, there is a 6% decrease in energy transmission due to absorption by progressively darker skin colours.

### WonBong Lim

**Department of Oral Pathology, School of Dentistry, Chonnam National University, Korea**

**Co-Authors: Jisun Kim, Sangwoo Kim, Sandeep Karna, Xui Zheng, Hongran Choi, Okjoon Kim**

---

#### *Modulation of lipopolysaccharide-induced NF-kappa B signaling pathway by 635nm irradiation via heat shock protein 27*

Heat Shock Protein-27 (HSP27) is a member of the small HSP family which has been linked to the NF- $\kappa$ B signaling pathway, which regulates inflammatory responses. Recently, clinical reports have suggested that low-level light therapy/laser irradiation (LLLT) could be an effective alternative treatment to relieve the inflammation during bacterial infection associated with periodontal disease. However, it is unclear how light irradiation can modulate the NF- $\kappa$ B signaling pathway. In the present study we examined whether 635nm irradiation could lead to a modulation of the NF- $\kappa$ B signaling pathway through HSP27 in HSP27-silenced cells, and analyzed the functional cross-talk between these factors in NF- $\kappa$ B activation. The results showed that 635 nm irradiation led to a decrease in the HSP27 phosphorylation, ROS generation, I $\kappa$ K/I $\kappa$ B/NF- $\kappa$ B phosphorylation, NF- $\kappa$ B p65 translocation, and subsequently led to a decrease in the COX-1/2 expression and PGE2 release in LPS-induced hGFs. However, in HSP27-silenced hGFs, no obvious changes were observed in ROS generation, I $\kappa$ K/I $\kappa$ B/NF- $\kappa$ B phosphorylation, NF- $\kappa$ B p65 translocation, and also in COX-1/2 expression, PGE2 release. This could be a probable mechanism by which 635nm irradiation modulates LPS-induced NF- $\kappa$ B signaling pathway via HSP27 in inflammation. Thus, HSP27 may play a potential role in regulating the anti-inflammatory response of LLLT.

### Jeri-Anne Lyons

**Department of Health Science, College of Health Science, University of Wisconsin-Milwaukee**

**Co-Authors: KA Muili, S Gopalakrishnan, JE Eells**

---

#### *Down-regulation of nitrosative stress by photobiomodulation induced by 670nm light in an animal model of multiple sclerosis*

Multiple sclerosis is a chronic autoimmune demyelinating disorder of the central nervous system. Current therapies targeting the immune response slow disease progression but do not prevent it, suggesting additional mechanisms are important to disease progression. A growing body of evidence suggests that nitrosoxidative stress is responsible acquired disability during chronic disease. Anecdotal data suggests that photobiomodulation induced by near red/far infrared light is beneficial in the treatment of multiple sclerosis. We previously demonstrated that 670nm light-mediated photobiomodulation improved the clinical course of autoimmune demyelination on our mouse model of multiple sclerosis. It was further shown that immune modulation played a role in disease amelioration. Numerous other studies demonstrate that near-infrared/far red light is therapeutically active through modulation of nitrosoxidative stress. As nitric oxide has been reported to play diverse roles in autoimmune demyelination, and recent studies suggest that axonal loss and progression of disability in these conditions is mediated by nitrosoxidative stress, we investigated the effect of 670 nm light treatment on nitrosative stress in our animal model of multiple sclerosis. Initial studies demonstrated down-regulation of nitric oxide production by antigen-specific lymphocytes in vitro. In addition, lower expression of inducible nitric oxide synthase was detected in the spinal cord of treated animals

during active disease. 670nm light treatment of mice deficient in inducible nitric oxide synthase failed to demonstrate a clinical effect on the disease course. Animals treated with 670nm light also demonstrated up-regulation of the protein Bcl-2, important in the prevention of apoptosis and an increased Bcl-2:Bax ratio, supportive of the protection from apoptosis in these animals. Reduced apoptosis within the spinal cord was confirmed by immunohistochemical staining. These data indicate that 670nm light mediated photobiomodulation protects against nitrosative stress and decreases apoptosis within the central nervous system in an animal model of multiple sclerosis.

## Gholamreza Majlesi Koopaei

IMLA

---

### *Low Power Laser as a Diagnostic Device*

Low power lasers are known as therapeutic devices, but specific therapeutic characteristics of laser can also be diagnostic of some pathologies. A unique characteristic of laser, selective absorption, yields diagnostic capability to laser devices. We used a continuous, 1000mW, 635nm, collimated beam for this purpose. In a semi-dark room, the laser beam irradiated some involved areas with known pathology. Based on pathology, laser beam was either not absorbed, over-scattered, or under-scattered in the involved site when compared with intact tissue. The pathologies we tested were haematoma, abscess and inflammation. Filler injected cheeks were irradiated as well; different types of fillers caused different scattering patterns. The location and periphery of haematoma or abscess was observed as a dark area in a red background. Our technique can easily find a hidden abscess or haematoma in a severely oedematous tissue. This could be important particularly for inflamed tissue clinically impossible to determine an abscess where ultrasound is unavailable. Results persuade you, in some cases, to substitute ultrasound with a red low-power laser. The advantage of red laser is direct inspection instead of looking at a sonogram. Hemangioma can not be found by ultrasound, but is easily found by red laser as a dark mass. As any method it has cons and pros. This can not be used for internal organs because of limited penetration of laser. Although at the beginning results were interesting, a great many studies with different wave lengths and different pathologies are needed to find more results, all parameters must be documented. For the applications mentioned above, it works.

## Sello Manoto

University of Johannesburg

Co-Authors: Nicolette Houreld, Heidi Abrahamse

---

### *Phototoxic effect of photodynamic therapy on lung cancer cells grown as a monolayer and three-dimensional multicellular spheroids*

#### **Introduction:**

Photodynamic therapy (PDT) is a minimally invasive therapeutic modality for the treatment of neoplastic and non-neoplastic diseases. The photochemical interaction of light, photosensitizer (PS) and molecular oxygen produces singlet oxygen and other forms of active oxygen, which results in tumour damage. The main advantages of PDT include a significant selectivity of the drug in tumour tissue, ability to retreat a tumour to improve the response, possibility to irradiate only cancerous cells and lack of systemic toxicity to the drug itself. This study aimed to investigate the subcellular localization of Zinc sulphophthalocyanine (ZnPcSmix) and whether the same pattern of cell death will be induced in lung cancer cells (A549) grown as monolayer cells compared to 3D cultured cells in vitro.

#### **Materials and Methods:**

Commercially purchased A549 cells used in this study were grown as a monolayer and multicellular tumour spheroids. Cells were divided into Photosensitizer only (control) and PDT (light and PS). ZnPcSmix at different concentrations [0, 5, 10, 20 and 40µM] was used and activated at a wavelength of 680 nm with 5J/cm<sup>2</sup>. Subcellular localisation of ZnPcSmix and reactive oxygen species (ROS) production was determined by fluorescence microscopy. Cellular responses were evaluated using cell morphology (light microscopy), cell viability (trypan blue), cell proliferation (adenosine triphosphate, ATP,) and cell membrane damage (lactate dehydrogenase).

#### **Results:**



ZnPcSmix localized in both mitochondria and lysosomes. Cells receiving neither light nor photosensitizer, showed no changes in cell morphology, proliferation, cytotoxicity and ROS production. However, light activated ZnPcSmix resulted in a significant production of ROS and a dose dependant decrease in viability, proliferation, and an increase in cell membrane damage in both monolayer and multicellular spheroids.

**Conclusion:**

ZnPcSmix photosensitizer used in this study localises in vital organelles and is effective in destroying lung cancer cells grown as a monolayer and multicellular spheroid through ROS production.

**Daiane Meneguzzo**

**Sao Leopoldo Mandic University**

**Co-Authors: Leila Ferreira, Luciana Lopes, Martha Ribeiro**

---

*Modified ILIB technique: clinical experience and new perspectives*

Intravascular Laser Irradiation of Blood (ILIB) is a technique developed in the 70s that is the introduction of an intravenous catheter with an optical fiber that irradiates blood with He-Ne laser (632.8nm). The benefits of ILIB include a systemic antioxidant effect, increased blood flow, anti-inflammatory effects, regulation of blood lipids, activation of immunologic cells, reduction of blood plasma viscosity allowing normalization of blood pressure, normalisation of ceruloplasmin content in the plasma, correction of hemocoagulative disorders, improvement of morphofunctional parameters of red blood cells restoring their normal forms, decreasing their transitional ones and increasing their electrophoretic mobility to normal values. Therefore, ILIB is being indicated for patients with vascular disorders, cardiac, diabetic and asthmatic. The modified ILIB technique (MIT) involves the laser irradiation (diode, 660nm, 100mW) continuously for 30 minutes on the surface of the skin at the wrist corresponding to the radial artery area. MIT is therefore non-invasive (the laser power used is capable of reaching the circulation), it is easy to perform and the benefits should be similar to those of ILIB. This work aimed to present our clinical experience with 12 patients treated with MIT. The technique has shown good results on the reduction of leg pain of diabetic patients, improvement of patient's general condition and mood, especially in patients undergoing antidepressant treatment. Moreover, MIT was effective when used once a week in combination with other local LLLT treatments on conditions including trigeminal neuralgia, systemic immunological depression, oral lesions and TMJ disorders. MIT is a new promising technique with great acceptability by patients, easy to use and has a large playing field in all areas of health.

**Daiane Meneguzzo**

**Sao Leopoldo Mandic University**

**Co-Authors: Luiz Thomaz, Leila Ferreira, Paulo Moraes, Helga Ferreira**

---

*LLLT treatment in early bisphosphonate-related osteonecrosis of the jaw in a patient with multiple myeloma*

Bisphosphonates (BP) have been widely used for the treatment of osteoporosis, malignant hypercalcemia, bone metastasis of solid cancers, and multiple myeloma bone diseases. However, BP may have serious side effects including a rare but painful condition that can affect quality of life: bisphosphonate-related osteonecrosis of the jaw (BRONJ). The prevention and treatment have not been established to date, but antibiotics are recommended to control the infection and it is also recommended to avoid surgical intervention at the risk of uncontrolled bone loss. LLLT was suggested for its ability to increase local microcirculation and stimulate bone healing, as well as to reduce the pain caused by BRONJ. A 56 year-old Caucasian patient from Campinas (Brazil) with multiple myeloma and treated with Zometa (BP) after an autologous bone marrow transplantation in 2007 reported pain and exposed bone in the region of left inferior molars for 45 days. Clinical evaluation showed early stage of BRONJ with intense pain and local inflammation. The patient underwent five sessions of laser therapy (1x per week) by diode laser with spot area of 0.028cm<sup>2</sup>, 100mW of power, with biostimulatory protocol: red laser (660nm), 0.5J per point (17.5J/cm<sup>2</sup>), 3 points around the lesion and analgesic protocol: 2 point of 2J (70J/cm<sup>2</sup>) infrared (810nm) in the opposite jaw site of damaged area. After the first session, the area of bone exposure had increased slightly and in the second session the appearance of the lesion did not change but patient did not report pain. After the third and fourth session the

exposed bone was found to be porous as characteristic bone sequestration. In the fifth section exposed bone was easily removed with presence of granulation tissue. The postoperative period of 15 days showed complete recovery of the affected gum area. The LLLT was effective in the treatment of early BRONJ in a patient undergoing Zometa promoting pain reduction and enabling tissue healing. Therefore LLLT can be an alternative treatment for early BRONJ suggesting a greater attention of oral professionals to recognise early lesions.

## Graham Merry

### NAALT

---

*A novel application of photobiomodulation in dry age related macular degeneration – results from the Toronto and Oak Ridge study (TORPA)*

#### **Purpose:**

Evaluation of Photobiomodulation as a new treatment for dry age-related macular degeneration (AMD). This is the first study globally to use low powered Light Emitting Diodes (LEDs) in AMD. Methods: IRB approved, prospective study. Subjects with dry AMD were consented and enrolled according to the protocol and outcome measures were assessed before and after the intervention. ETDRS Visual Acuity, Contrast Sensitivity and Fixation Stability (Bivariate contour elliptical area method) were assessed pre treatment, immediately post treatment and at 4, 6 and 12 month intervals. Devices were Warp10 (Quantum Devices) and Gentlewaves (Light Bioscience).

#### **Treatment Parameters:**

Warp10: 670nm +/- 15nm at 50-80mW/cm<sup>2</sup>, 4-7.68J/cm<sup>2</sup>, for 88 +/- 8 seconds. Gentlewaves: 590nm +/- 8nm at 4mW, 790nm +/- 60nm at 0.6mW, for 30 seconds. Subjects treated 18 times over a six week period with both devices.

#### **Results:**

Final data: 18 enrolled eyes. Repeated measures ANOVA for ETDRS Visual Acuity (logMAR): F (4,68) = 18.86, p less than 0.0001 Repeated measures ANOVA for Contrast sensitivity (3cycles/degree): F (4,68) = 11.44, p less than 0.0001 Repeated measures ANOVA for Contrast Sensitivity (1.5 cycles/degree): F (4,68) = 4.39, p less than 0.0032 Repeated measures ANOVA for Fixation Stability (BCEA): F (4,68) = 0.90, p less than 0.4661 Correlation analysis between Fixation Stability and ETDRS VA showed Pearson R value of 0.6776, p less than 0.001

#### **Conclusions:**

Statistically significant improvement in Visual Acuity and Contrast sensitivity immediately following the treatment and remaining statistically significant at one year. Fixation stability did not show statistically significant improvement however correlation analysis with Visual acuity did show a significant correlation improvement after the treatment. This is an effective, non invasive, easily administered and safe treatment with no serious adverse events noted.

## Nenad Milovanovic

**Clinic for Rehabilitation , Medical School, Belgrade, Serbia**

**Co-Authors: Ljubica Konstantinovic, Stevan Jovic, Aleksandar Pavlovic, Zeljko Kanjuh, Dragana Petrovic, Aleksandra Sekulic**

---

*Low level laser therapy in treatment of acute low back pain with radiculopathy*

#### **Objective:**

The aim of this study was to investigate therapeutic effects of low-level laser therapy in patients with acute low back pain with radiculopathy.

#### **Background Data:**

Acute low back pain with radiculopathy is associated with pain and disability and the important pathogenic role of inflammation. Low-level laser therapy has shown significant anti-inflammatory effects in many studies.



### Materials and Methods:

A randomised, double-blind, placebo-controlled trial was performed on 60 patients. Group A (30 patients) was treated with Diclofenac sodium 50mg three times a day for the first 10 days and simultaneously with active low-level laser therapy; group B (30 patients) was treated with same drug treatment and placebo low-level laser procedure. Low-level laser therapy was applied behind the involved spine segment using a stationary skin-contact method. Patients were treated five times weekly, for a total of 15 treatments, with the following parameters: wavelength 780 nm, frequency 300Hz, average output of the laser 5.1mW; each treatment session irradiated 4 points, with dose of 10J/cm<sup>2</sup>, treatment time 984 seconds for a whole dose of 40J/cm<sup>2</sup>; spot size 0, 12cm<sup>2</sup>, power density 40,605mW/cm<sup>2</sup>, accumulated energy delivered from all sessions 600J/cm<sup>2</sup>. The outcomes were pain intensity measured with a visual analogue scale, lumbar mobility measured by Schober test, and pain disability with Oswestry disability score.

### Results:

Statistically significant differences were found in group A after active laser therapy in reducing pain intensity ( $Z = 4.816$ ;  $p < 0,001$ ), reducing of Oswestry disability score ( $t = 29.846$ ;  $p < 0,001$ ) and increasing lumbar mobility ( $t = 46.9$ ,  $DF = 29$ ,  $p < 0.001$ ).

### Conclusions:

The results of this study show better improvement in acute low back pain patients treated with Diclofenac sodium and simultaneously with active low-level laser therapy versus patients treated only with drugs and placebo procedure.

# SpectraMedics

tomorrow's medicine today™

**SPECTRAVET**  
**THERAPEUTIC LASERS**  
Veterinary Therapeutic Lasers

**Irradia**  
MEDICAL LASER SYSTEMS

**SpectraMedics is a specialist supplier of laser medicine and photobiomodulation equipment.**

With over 16 years' experience and globally-recognized as experts in our field, SpectraMedics offers the largest range of output power and wavelength options available for both veterinary and human medicine and research. We will provide you with the ideal system for your specific needs, and the information you need to use it safely and effectively.

**[www.spectramedics.com](http://www.spectramedics.com)**



## Soheila Mokmeli

COL, Canadian Optic and Laser Production

Co-Authors: Maraym Payvand

---

*Comparing the effects of 980nm and 830nm lasers in pain control of knee osteoarthritis*

### **Background:**

Laser therapy is an approved pain controlling method in the world however there are challenges and questions for the therapeutic parameters. Most companies are competing for their products because of differences and benefits and one of them is wave lengths. In this study the effects of 980nm, 200 mW continuous laser and 830nm 200 mW continuous laser were compared in pain controlling of knee osteoarthritis.

### **Material and Methods:**

Fifty knee osteoarthritis patients after writing consent were divided in two groups (N = 25). The Group A was treated with 980nm laser and Group B was treated with 830nm laser. Both groups were treated with the same therapist, the same therapeutic method and were evaluated by the same physician. All of the patients, therapist and physician were blind about the groups' allocation. Before the first session and after the 12 sessions of laser therapy (three sessions per week) all patients were evaluated for pain number by VAS, pain and stiffness subscales of WOMAK index and oedema by supra patellar size.

### **Results:**

Results were analyzed by SPSS program. There was a significant decrease in pain, stiffness and oedema in each group at the end of treatments ( $p < 0.001$ ) In addition, there was no significant difference for pain number, stiffness, walking pain, standing pain, Night Pain, and oedema ( $p < 0.001$ ) between the groups at the end of treatment.

### **Conclusion:**

Although there was difference in wave length and the transmission of 830nm is 25 times higher than it is for the 980 nm, both lasers had considerable effects on pain reduction in knee osteoarthritis.

## Shigeyuki Nagai

---

*Implantology and aesthetic dentistry*

Implantology and aesthetic dentistry are the recent topic in the dentistry. Both treatment help the quality of life for the patient and are supported by the latest technologies. Lasers have been used for the soft with the good hemostasis and the hard tissue treatment include the bone ablating with the less thermal damage. These benefits of the laser treatment are useful for the implant treatment and the aesthetic treatment. Most of the dental laser can be used for the gingivoplasty and recounter the soft tissue dental margine line, removal of pigmented tissue and the teeth whitening for the aesthetic purpose. Er:YAG laser can be used for the osseous crown lengthening and also excellent for the implant treatment. In this lecture various usage of dental lasers will be talked in the field of implantology and aesthetic dentistry.

## Raj Nair

Griffith University and Haematology and Oncology, Queensland Health

Co-Authors: RJ Bensadoun

---

*Photomedicine using low level laser in orofacial complications of cancer therapy*

Photomedicine using low level laser therapy (LLLT) has been shown to be effective in reducing the severity of oral mucositis (OM) due to different cancer therapies since reports from the early nineties. The mounting scientific evidence is promising and empirical to believe that photomedicine will soon become common practise in the preventative and therapeutic regimen of OM management. Common features of orofacial manifestations of cancer



therapy including, chemotherapy, radiation therapy and stem cell transplantation (SCT) will be discussed along with an update on current knowledge on LLLT for RT-induced, chemotherapy-induced and oral mucositis in SCT. This presentation will briefly review the results of a meta-analysis of 33 articles consisting of nine reviews, six case studies and three animal studies with a final sample of 11 randomised placebo-controlled trials. The other aspects discussed include the current status of intra-oral and extra-oral devices that could be used in OM. Most importantly the parameters to be considered when calibrating LLLT devices for OM and the significance of clinical evaluation, trained clinicians and instructions on when, where and how photomedicine therapy should be employed in patients with OM while undergoing cancer therapy.

## **Poliani Oliveira**

**Federal University of Sao Carlos**

**Co-Authors: Anderson Santos, Karina Pinto, Nivaldo Parizotto, Ana Renno**

---

### *Effects of low level laser therapy on the articular cartilage in an experimental model of osteoarthritis*

Osteoarthritis is the most common form of arthritis and is characterized as a chronic disease that affects synovial joints, causing degeneration and inflammation. Several experimental models have been widely used in studies to understand the pathophysiological aspects inherent in the degeneration of articular cartilage, as well as to investigate the therapeutic potential of conduct in relation to modulation of the disease. The aim of this study was to evaluate the effects of laser therapy on the degenerative modifications in articular cartilage after anterior cruciate ligament transection (ACLT). We used sixty-male rats (Wistar), distributed into three groups: intact (IG), injury control (CG), injury laser treated, at 50J/cm<sup>2</sup> (L50G). Animals were distributed into 2 subgroups, with different periods of sacrifice (subgroup A and B, sacrificed 5 and 8 weeks post-surgery). The animals were submitted to the surgery to induce OA by anterior cruciate ligament transection. Laser treatment started 2 weeks after the surgery and it was performed for 15 (sub-group A) and 30 sessions (sub-group B). A laser 685nm, at 50J/cm<sup>2</sup>, 30mW was used. To evaluate the laser effects, we performed semi-quantitative analysis of cellularity and proteoglycan, morphometric analysis of cellularity and thickness and quantification of total collagen fibers. In semi-quantitative and morphometric analysis of cellularity, the CG group showed more cellularity compared to IG and L50G groups in second period. Proteoglycan analysis showed that CG and L50G groups present loss of proteoglycan compared with IG. Thickness morphometric analysis showed CG and L50G showed more thickness compared with IG group in two periods analysed. There were no differences between groups in quantification of total collagen fibres. In conclusion, laser therapy 685nm, at 50J/cm<sup>2</sup>, period of 8 weeks was beneficial to articular cartilage.

## **Uri Oron**

**Tel-Aviv University**

---

### *Induction of autologous mesenchymal stem cells at the bone marrow by low level laser therapy has beneficial effects on the ischemic heart and kidney*

Multiple clinical trials were performed recently on the use of various stem cells to the ischemic heart. The general outcome of these trials was that the procedures are safe but improvement in the functional performance of the heart was marginal. Acute renal failure has a 50-80% mortality rate. Currently, treatment options for this life-threatening disease are limited. The aim of the present study was to demonstrate that low level laser therapy (LLLT) application to stem cells at the bone marrow (BM) may have beneficial effects on the infarcted rat heart post myocardial infarction as well as ischemic kidney. LLLT applied to the infarcted area in the heart caused a significant reduction of 39% in the infarct size compared to control infarcted, non-laser treated rats. LLLT applied directly to stem cells in the BM caused significant ( $p < 0.001$ ) reduction of 79% in the infarct size compared to control. Ventricular dilatation measurements also showed a marked reduction (74%,  $p < 0.001$ ) in the laser treated rats compared to control. In the group of rats in which LLLT was applied to the BM a significant ( $p = 0.05$ ) elevation of 27-fold in the density of c-kit immunopositive cells (a marker of MSCs) in the infarcted area as compared to control was noticed. Electron microscopy indicated newly formed cardiomyocytes at the hearts of the laser treated rats. Quantitative histomorphometric analysis of the histological sections revealed that dilatation of the renal tubules

had been reduced, structural integrity of the renal tubules restored, and reduced necrosis in the laser-treated rats as compared to the control non-laser-irradiated group. In conclusion, the present study demonstrates a novel approach of applying LLLT to autologous BM of rats with ischemic heart or kidney in order to induce stem cells that are consequently recruited to the ischemic organs, leading to a marked beneficial effect to the heart post-myocardial infarction. The possibility that this approach can also be applied to other ischemic/injured organs or organs undergoing degenerative processes, with consequent beneficial effects there too, cannot be ruled out.

## **Milena Palazon**

**Universidade de Sao Paulo**

**Co-Authors: Taás Scaramucci, Ana Cecilia Aranha, Youssef Michel, Renato Prates, Karina Lachovyschi, Karina Lachovyschi**

---

### *Immediate and long term effects of Nd:YAG laser irradiation and in-office desensitizing treatment on tubule occlusion*

The objective of this in vitro study was to evaluate the immediate and long-term effects of Nd:YAG laser and in-office desensitizing treatment on dentin tubule occlusion. Forty-eight dentin slabs (4x4x2 mm) were sectioned from the roots of human third molars, ground flat, polished and randomly divided into four experimental groups (n=12):

- Group 1: Control (no treatment),
- Group 2: In-office Colgate Sensitive Pro-Relief Desensitising Paste,
- Group 3: In-office prophylaxis with pumice,
- Group 4: Nd:YAG laser irradiation (Power Laser<sup>TM</sup> ST6, Lares Research, 100mJ, 85J/cm<sup>2</sup> per pulse with a quartz fibre of 400mm, in scanning movements).

Treatments were applied according to the manufacturer's instructions. After that, the specimens were submitted to a sequence of erosive (citric acid) and abrasive (brushing simulator machine) challenges twice per day for 1 week. The specimens were qualitatively and quantitatively evaluated by Scanning Electron Microscopy, immediately after treatment, and after 4 and 5 days respectively. The response variable was the amount of occluded dentin tubules per area, calculated with visual criteria using a standardised grade of PowerPoint program and 3 different examiners. Statistical analysis using the Friedman's test showed 0,76. ANOVA with Tukey's test showed differences between groups for the times studied ( $p < 0.05$ ). Observing the images, it could be seen that tubule occlusion occurred for all groups immediately after treatment, however, the laser group showed the most satisfactory results with smaller diameter of dentinal tubules. After challenge, Colgate sensitive paste showed the best performance in maintaining tubule occlusion. More opened dentinal tubules were observed for both pumice and laser groups. In conclusion, all in-office treatments were capable of sealing dentinal tubules immediately with the laser group being more satisfactory; however, after erosive and mechanical challenge, Colgate in-office paste showed a more pronounced effect in maintaining tubule occlusion over time.

## **Neil Piller**

**Flinders Medical Centre**

---

### *Lymphoedema and Low Level Laser; Sequencing and Targeting in the treatment process*

Lymphoedema is a consequence of the failure of the lymphatic system to remove the awaiting lymph load. It still occurs in about 20%-30% of patients who receive treatment for cancer and has a significant effect on a patient's quality of life and activities of living. The surgery and radiotherapy as well as the progression of lymphoedema mean local and diffuse areas of fibrotic induration, which reduce fluid movement, result in inflammatory mediators and adipogenic factor build-up, further exacerbating the lymphoedema. Low level Laser has been successfully since the mid 90's in the treatment of lymphoedema. There are studies showing its ability to reduce fibrotic induration, thus softening the tissues (measured by indurometry), improving lymph flow and helping to manage lymphoedema. Associated with these are strong subjective comments of improvements. As lymphoedema progresses it changes from a fluid rich stage, through a fatty stage to a fibrous stage. Current evidence suggests it is best to target laser treatment on the specific and general areas of fibrotic induration prior to attempting therapies such as Manual Lymphatic Drainage, which are aimed at improving loading



and flow of lymph. While the exact mode of LLLT on the lymphatics and lymphoedema tissues is not certain, it seems to work by facilitating subtle changes to the fibrous (collagenous) tissues, making them more attractive to mononuclear phagocytes as well as stimulating lymphangio-motoricity and a bacterio-static action. LLLT for is widely used by some clinics yet in others there is a reluctance to accept current evidence.

### **Ana Maria Pinto**

**Research and Education Center for Photo Therapy in Health Sciences**

**Co-Authors: Luciana Almeida-Lopes, Daiane Meneguzzo**

---

#### *Low Level Laser Therapy and biological dressings: a new solution for treatment in chronic wounds*

Low-level laser treatment (LLLT) has been used in several areas of health due to its effects regarding tissue healing acceleration, modulation of inflammation process and analgesia. This study aims to present 10 clinical cases of elderly patients with chronic wounds treated with LLLT and biological dressings. Ten patients with chronic wounds (vascular wounds, pressure ulcers or wounds resulting from trauma in diabetic patients) of Sao Vicente de Paula asylum in Itapira, Brazil, were selected and authorized for the laser treatment. After conventional mechanical cleaning care, wounds were irradiated weekly with a diode laser (660nm and 830nm), with a spot area of 0,028cm<sup>2</sup> and output power of 100mW, using energies that ranged from 0.5 to 4 Joules per point (17-140J/cm<sup>2</sup> per point) according to the painful symptoms, and stage of lesion. Photodynamic therapy (PDT) was also performed in infected wounds (methylene blue 0.01% in the aqueous solution + 660nm, 100mW, 9 Joules, 315J/cm<sup>2</sup>, 90 seconds of irradiation). After laser irradiation, a bacterial cellulose membrane dressing was applied and changed when necessary. Pain, wound size, oedema, erythema, granulation tissue formed and improved quality of life of patients were evaluated by photography and patients reports. Wound healing occurred between the 4th and 20th LLLT sessions. The pain has shown to be absent after 1 to 3 sessions, which allowed some patients to return to their normal activities without wheelchairs. The mean closure of wounds per session was 1-2mm, with stimulated formation of granulation tissue and absence of necrosis. The gradual healing of wounds was accompanied by an improvement of patients' mood, motivation, and high acceptability of treatment. LLLT showed effective in chronic wounds healing and pain associated with biological dressings showing no side effects and wide acceptability by elderly patients.

### **Ana Renno**

**Federal University of Sao Paulo**

**Co-Authors: Karina Zambone Pinto Rossi, Carla Tim, Bruno Rossi, Nivaldo Parizotto**

---

#### *Low level laser therapy enhances the expression of osteogenic factors during bone repair in rats*

The aim of this study was to evaluate the effects of low level laser therapy (LLLT) on bone formation, immunoexpression of osteogenic factors and callus biomechanical properties in a tibial bone defect model in rats.

#### **Background Data:**

Despite the positive effects of LLLT on tissue regeneration, the molecular mechanisms of its action on bone healing are not fully elucidated.

#### **Methods:**

Sixty male Wistar rats with bilateral tibial defects were randomly distributed into two experimental groups: laser group and control group. Laser irradiation (830nm, 120J/cm<sup>2</sup>, 100mW) started immediately after surgery and it was performed for 8, 15 and 23 sessions, with an interval of 48h. Animals were sacrificed on days 15, 30, and 45 post-injury.

#### **Results:**

The histological and morphometric analysis showed that the treated animals presented no inflammatory infiltrate and a better tissue organisation at 15 and 30 days post-surgery. Also, a higher amount of newly formed bone was observed at 15 days post-surgery. The immunohistochemical analysis showed that laser irradiation produced a higher expression of COX-2 at day 15 post-surgery, a positive immunoexpression of RUNX-2 during all periods

evaluated, a higher immunoexpression of BMP-9 at day 30 after surgery and a higher immunoreactivity of RANKL at the day 15. However, no difference in the mechanical properties of the bone callus was observed between treated and control groups.

## **Conclusion:**

Our findings indicate that laser therapy improved bone healing, by accelerating the development of newly formed bone and activating the osteogenic factors on tibial defects.

## **Daniel Ribeiro**

**Federal University of Sao Paulo**

**Co-Authors: Ana Claudia Renno, Beatriz Peres, Natalia Rodrigues, Roberta Brunelli, Renata Toma, Carla Medalha**

---

### *The effects of Low Level Laser Therapy on Injured Skeletal Muscle*

The main purpose of the present study was to investigate the effects of low-level laser therapy (LLLT) used in two different fluencies on injured skeletal muscle after cryolesion by means of histopathological analysis and immunohistochemistry for COX-2. A total of sixty male Wistar rats were randomly distributed into 3 groups: injured animals without any treatment; 808nm laser treated group, at 10J/cm<sup>2</sup> and 808nm laser treated group, at 50J/cm<sup>2</sup>. Each group were divided into two different subgroups (n=10) on days 6 and 13 post-injury. The results showed that animals irradiated with laser at 10J/cm<sup>2</sup> or 50J/cm<sup>2</sup>, presented areas with cell infiltrate and pointed out to minor and mild areas with destroyed zones if compared with the control group and. Also, a COX-2 down regulation was noticed in the groups exposed to laser at two fluences evaluated in this study. Statistically significant differences (p<0,05) were noticed to collagen deposition in the laser treated animals, with the fluence of 50J/cm<sup>2</sup> when compared to the other groups on day 13 post-surgery. Taken together, our results suggest that laser therapy has positive effects on muscle repair in rats after cryolesion.

## **Shimon Rochkind**

**Tel Aviv University, Israel**

---

### *Effectiveness of Laser Phototherapy for Peripheral Nerve Recovery and Related Motor Function*

## **Background:**

Post-traumatic nerve repair and prevention of muscle atrophy represent a major challenge of restorative medicine. Considerable interest exists in the potential therapeutic value of laser phototherapy for restoring or temporary preventing denervated muscle atrophy as well as enhancing regeneration of severely injured peripheral nerve.

## **Methods:**

Laser phototherapy was applied for treatment of rat denervated muscle, as well as on rat sciatic nerve model after crush injury, direct or side-to-end anastomosis and neurotube reconstruction. Nerve cells' growth and axonal sprouting were investigated on embryonic rat brain cultures. The animal outcome allowed clinical study on patients suffering from incomplete peripheral nerve injuries.

## **Results:**

In denervated muscle, animal study suggests that function of denervated muscles can be partially preserved by temporary prevention of denervation-induced biochemical changes. The function of denervated muscles can be restored, not completely but to a very substantial degree, by laser treatment, initiated at the earliest possible stage post-injury. In peripheral nerve injury, laser phototherapy has a protective and immediate effect, it maintains functional activity of the injured nerve, decreases scar tissue formation at the injury site, decreases degeneration in corresponding motor neurons of the spinal cord and significantly increases axonal growth and myelination. In cell cultures, laser irradiation accelerates migration, nerve cell growth and fibre sprouting. In a pilot, clinical, double-blind, placebo-controlled randomized study in patients with incomplete long-term peripheral nerve injury, 780nm laser irradiation can progressively improve peripheral nerve function, which leads to significant functional recovery.





### **Conclusions:**

Animal and clinical studies show the promoting action of phototherapy on peripheral nerve regeneration, which makes it possible to suggest that the time for broader clinical trials has come. Laser activation of nerve cells, their growth and axonal sprouting can be considered as potential treatment of neuronal injury

### **Hans Romberg** **Medizintechnik**

---

*Experimental workshop: light distribution in tissue. What is a power density for laser or LED clusters?*

In clinical applications, as well in basic research, the dosage of applied laser or LED light is, besides the wavelength, the most important parameter. Dosage can be given in total energy (J), total energy density ( $\text{J}/\text{cm}^2$ ), power (W or mW) or power density ( $\text{W}/\text{cm}^2$  or  $\text{mW}/\text{mm}^2$ ). Which of these may be decisive in different applications? We will distinguish between aimed-at regions being either close to surface or deep inside tissue, and being either small (e.g. 1 mm in diameter) or large (e.g. 5 cm in diameter). Discussed light sources will be focused, or defocused lasers and single LED. Furthermore, emphasis will be put on cluster light sources. The form of the light distribution in tissue will be looked at, and we will discuss how to define power density. How do we apply WALT Dosage Recommendations using a cluster? Do we have to regard the cluster in total, or to look at individual LED? In laser safety both aspects have to be considered and understood. In this workshop we will perform simple experiments that can be done by every laser or LED user, to get a feeling for the penetration of light into tissue. We will discuss the WALT guidelines being prepared with regard to specification of laser parameters in scientific publications, and the integration of clusters therein.

### **Hans Romberg** **Medizintechnik**

---

*Amplification, regulation, and a simple model for the biphasic dose-effect relationship for laser and LED phototherapy*

The strong effects of the soft low-level laser therapy can only be understood by assuming strong in-body amplifications. This corresponds to the PAsER-concept of Mary Dyson (Patient Amplification of the Spontaneous Effect of Radiation<sup>(1)</sup>). These amplifications can be gained by intervening in the regulation. It is known that LLLT can modulate biophysical and biochemical properties, as electric membrane potentials, local temperatures, or by activating biochemical reactions. Thus, we are in a situation where LLLT is expected to influence more than one regulatory system. These influences are expected to be saturable. We will show, that a simple mathematical model for this situation can lead to the observed biphasic dose-effect relationship<sup>(2)</sup>. (1): Mary Dyson, WALT 2010 congress (2): Michael Hamblin et al., WALT 2010 congress.

### **Hans Romberg** **Medizintechnik**

---

*Is there a threshold in the dose-effect relationship for LLLT?*

The interpreted threshold in data plotted logarithmically in dosage will be shown to be a mathematical artefact at least in some cases. However, from quantum physical principles there should be a minimal dosage. We will try to estimate that, depending on wavelength, absorption, working depth, and other laser parameter. It is worth noting, that the laser power is not the most important parameter!

### **Hans Romberg** **Medizintechnik**

---

*Quantum physics for dummies*

In this course the basics of quantum physics will be presented as understandably as possible. There will be enough time for questions. Does light behave as a wave? Does light act as a particle? If we look deeply we find that Nature no longer follows our idea of 'common sense'. This gives rise to philosophical questions about reality and existence.

We will present an approach that is aimed at giving those who have never studied physics or quantum physics a feeling for some strange natural phenomena. What is coherence? What is interference? How is light created in a light bulb, and how in a laser? What are the consequences for beam geometry and laser/LED safety?

**Gerry Ross**

**Private Practice, USA**

---

## *Craniofacial Pain Treatment for Health Professionals*

Craniofacial pain, including TMJ disorders, is debilitating for patients and often frustrating for health practitioners. Laser Therapy is an effective treatment technique that reduces pain, increases collateral and microcirculation and lymphatic flow, all which alleviate the painful symptoms of some craniofacial disorders. Laser Therapy is most effective when the fundamentals of craniofacial pain are addressed; therefore, this presentation will outline the anatomy of the joint the function of the muscles, and discuss the importance of obtaining a detailed patient history and performing a thorough physical examination. We will focus on determining a differential diagnosis for a number of cases and the associated modality utilised in the treatment, including lasers and LED, but excluding drugs. Treatment protocols will be outlined in detail and will include recommended dosages when treating trigger points, acupuncture points, joints and large muscles. Further, treatment of one of the great challenges, i.e. centrally mediated or neuropathic pain, will be explored. This presentation is geared to all health professionals and will outline how they can work together to achieve the most successful treatment possible.

**Gerry Ross**

**Private Practice, USA**

---

## *In Search of Dental Anesthesia*

It has been well established that Laser irradiation can give analgesia by affecting the conduction of the C fibres, the nerve fibers that carry pain impulses from the dental pulp to the brain. Currently, laser irradiation with an infrared (830nm) wavelength for analgesia is being used very successfully in a number of dental procedures. Thus far, however, the effect of laser irradiation has been limited to analgesia. Recently Dr Roberta Chow reported a great deal of success by utilizing the visible red wavelength in peripheral nerves. Preliminary results have indicated that analgesia is being obtained, and in some cases, it was thought that anesthesia was achieved. However, in dentistry, the nerves being irradiated are cranial nerves, which may react differently to peripheral nerves. This presentation will outline a number of cases in which dental analgesia had been successfully used for conditions such as restorative procedures and crown preparation. In addition, the preliminary results of the clinical study investigating the use of visible red laser irradiation in a variety of dental cases will be presented. Preliminary results will include subjective reporting of pain levels based on survey results from a visual analogue scale.

**Gerry Ross**

**Private Practice, USA**

---

## *Treatment of Neuropathic Pain and Trigeminal Neuralgia*

The literature shows very mixed results in the treatment of facial neuropathic pain and trigeminal neuralgia. The author has experienced very little success from the first fifteen years of treating these cases locally with low level lasers. This presentation will discuss 4 cases of increasing complexity in which the laser was used to successfully treat these very challenging cases. During this study, 808-830nm wavelengths were used to treat the ganglion and a combination of 808, 830 and 660nm lasers, as well as a 670nm cluster LED, were applied locally. The two key points that have changed the success rate are 1) the treatment of the trigeminal ganglion and 2) the necessity to titrate both the laser wavelength and dosage. The author will illustrate the anatomical points used to achieve treatment of the trigeminal ganglion. The results from these case studies show promise for treating a condition for which both traditional methods and previous laser treatments have had very mixed success. Larger scale studies are warranted from the promising results demonstrated here.



## Gerry Ross

Private Practice, USA

---

### *The Use of Low Level Laser Therapy in Dentistry*

There is a growing interest in using low level laser therapy as a treatment modality in dentistry for wound healing, pain relief, muscle relaxation and nerve regeneration. Often, too much emphasis is placed on using specific laser units to achieve clinical results. This presentation will explain how dentists can successfully utilise laser therapy in their practices regardless of the laser being used. The key to success with low level laser therapy, or photobiomodulation, is based on proper technique and an understanding of the optimal wavelength and dosage to achieve the desired effect. The workshop will focus on the most commonly used clinical applications, including: Post Surgical reduction of post-operative pain, swelling and bruising, while stimulating healing Dry Socket; reduction of pain and stimulation of the endothelial pocket Implants/ Bone Grafting; LLLT will reduce pain, speed the integration of the implant and improve the bone quality around the implant as a result of the stimulation of osteoblasts Paedodontics; laser therapy can provide analgesia for enhanced restorative dentistry and decrease the gagging and nausea some patient feel during appointments Soft Tissue Lesions; LLLT will decrease pain and speed the healing of soft tissue lesions, including herpes simplex, aphthous ulcers, lichen planus and oral mucositis Soft Tissue Surgery; laser irradiation after soft tissue surgery will stimulate fibroblast for better soft tissue healing and reduced pain, making it an excellent adjunct to surgical lasers TMJ; LLLT can be used to relax muscles and decrease pain associated with facial pain, both acute (e.g. after long appointments) and chronic (e.g. osteoarthritis) Endodontics; laser therapy can effectively be used after endodontic surgery, for diagnosis of pulp hyperemia, and treatment of dentin hypersensitivity. The aim of this course is to give the attendees a chance to learn the clinical applications of low level laser therapy while enabling them to evaluate these applications on an evidence-based format. Participants will leave this course with all the tools required to utilize laser therapy in their practice comfortably and predictably.

## F Rostum Ihsan

Faculty of Medicine – Al-Muthanna University

Co-Authors: Dunnia Abdullah Barakat, Sattar Hussein Ali

---

### *Accelerating Wound Healing and Skin Loss Sealing Using Low Level Laser Therapy*

#### **Background:**

Many therapeutic aids are used to accelerate wound healing and promote healing processes. The knowledge base about the role of Low Level Laser Therapy (LLLT) in regeneration processes continues to grow especially in the fields of dermatology and cosmetic surgery.

#### **Objective:**

The aim of the current study was to present an overview of the interrelationship between the hormones involved in wound healing and irradiation with Low Level Lasers.

#### **Materials & Methods:**

The experiment was conducted on twenty adult male New Zealand rabbits, divided into two groups with 10 rabbits each: group 1 (induced wound group) and group 2 (lost skin group).

The animals of the first group underwent a surgical operation on the lateral aspect of the left thigh wherein a surgical wound with 7cm length was made and then closed by simple interrupted stitches using surgical silk 3-0. The second group underwent operative removal of a whole thickness skin square graft of (1cm<sup>2</sup>) dimensions. The animals of each group were divided into two subgroups (control and treated with laser irradiation). The laser used was diode with wave length 820nm and output of 200mW. Irradiation began after the operation and continued for three days in the animals of the induced wound subgroup and seven days in the skin loss subgroup animals with 1.2 minute /session daily. Irradiation with the laser was done by directing the beam (1cm) distance from the wound or around the square area of the lost skin. Blood samples were collected at days 0, 1, 3 & 7 from the animals of the 1st group and days 1, 3, 7 & 10 in the animals of the 2nd group. The samples were taken from the marginal ear vein from all animals and sent for examination with Eliza to

determine the levels of Prostaglandin E2 (PGE2), Prostaglandin F2 $\alpha$  (PGF2 $\alpha$ ), Growth hormone (GH) and cyclic Adenosine Monophosphate (cAMP). Results were tested statistically using Minitab and SPSS regression test.

## **Results:**

Clinically, the animals of the first group showed significant variations in the time of healing being about four days in the treated subgroup and eight days in the control group. The stages of the skin defect's contraction and sealing, was faster in the animals of the treated subgroup taking nine days, while it took fifteen days in the control subgroup.

Statistical evaluations revealed significant variations in the values of PGE2, PGF2 $\alpha$ , cAMP and GH, between the two subgroups of the 1st group,  $P > 0.05$ . Hormonal assessment of PGE2, PGF2 $\alpha$ , cAMP, GH and the diameter of the skin defect for the animals of the 2nd group showed significant variations between the two subgroups  $P > 0.05$ . Conclusions: Treatment of surgical wounds and skin disorders with low level laser radiation is efficient to promote and accelerate the primary healing.

## **F Rostum Ihsan**

**Faculty of Medicine – Al-Muthanna University**

**Co-Authors: Heda`a M. Nahaab, Ghazi, M. Al-Khatib**

---

### *Preparation of Abortion Pathogenic bacterial Vaccine using Laser Irradiation*

## **Background:**

Despite the wide variation in laser intensity required for inactivation of human cells and microorganisms such as bacteria and viruses, laser irradiation is capable of providing treatments against some of the worst, drug-resistant, bacterial and viral pathogens.

## **Objective:**

The study aimed to detect the bacterial causes of abortion in women and to illustrate the mechanisms of killing or attenuating of bacteria using low level energy laser in order to produce a multiple vaccine.

## **Materials and Methods:**

Of 103 samples collected from females following abortion, 56 bacterial isolates obtained representing a rate of 54.3% from the total number of the 103 samples. The results showed that the primary positive bacterial isolate was *S. agalactiae* (hemolytic or non hemolytic) 33.9%, with *Staph. aureus* ranked second, while *Salmonella*, *E.coli*, *Klebsiella* and *Paeruginosa* ranked third in order of presentation. Other isolates were *Brucella* and *Listeria* in addition to *E. cloacae*. Antimicrobial sensitivity of the bacterial isolates conducted before laser irradiation using twelve antibiotics, showed high resistance for all antibiotics except Amikacin. Irradiation of isolates with diode laser using wavelength (660) nm, out put (50 and 250) mw, frequency (1-10) kHz, revealed clear effects on the bacterial sensitivity to antimicrobial agents which increased bacterial kill. In addition, bacterial count decreased, loss of blood hemolysis and production of biocyanine stain from *Paeruginosa* was seen with increasing time of exposure to irradiation culminating to the killing and attenuating the bacteria to prepare vaccine.

To determine the level of the immune response after inoculation of the killed and attenuated vaccine, 24 male rabbits were divided into six groups with 4 rabbits each. After 35 days (the immunisation period) blood samples were collected from all the experimental animals to determine systemic immune response parameters (humoral) to compare the immunised animals with the control animals, which were injected with normal saline. Then all the animals were injected with challenge dose. The humoral immune response was also studied using Radial Immunodiffusion test (RID) to determine the immunoglobulin's concentration for the IgM, IgG, and IgA.

## **Results:**

Immunoglobulin concentration rates were higher ( $P > 0.05$ ) in the test subgroup animals compared with those of the control group. The live attenuated vaccine induced highly immune response as compared with killed vaccine. The control subgroup animals died when injected with the challenge dose while the immunized animals remain healthy.

**Conclusions:**

Low level laser irradiation can attenuate or kill the pathogenic microorganisms which are responsible for causing abortion in humans and this feature enabled us to prepare a multiple vaccine against pathogens.

**F Rostum Ihsan**

**Faculty of Medicine – Al-Muthanna University**

**Co-Authors: Nabeel Khudhair Hassoon**

---

*Effect of Low Level Laser on the Bacterial Isolations from Bile*

**Objective:**

To use laser irradiation to attenuate or kill pathogenic bacteria isolated from the human gallbladder to prepare a vaccine consisting of all the bacteria isolated from the bile and to use it in immunising the patients who exhibit problems in their biliary system.

**Background:**

A variety of microorganisms isolated from the bile are responsible for causing Cholecystitis. A large number of remedies and antibiotics are used to prevent the infection or to treat it.

**Materials & Methods:**

Five microorganisms isolated from forty samples taken from patients underwent cholecystectomy operations. The isolated bacteria were killed and attenuated using diode laser to prepare a mixed vaccine. Seventy two rabbits underwent the vaccination program. Rabbits were divided in to 6 groups with 12 rabbits each, 5 of them were specified for each type of the bacteria, while the last group was specified for the mix vaccine. Each group was subdivided in to three subgroups with 4 rabbits each: one was inoculated with live attenuated vaccine, the second was inoculated with killed vaccine, the third was considered as the control subgroup. The humoral immune response was studied using radialimmunodiffusion test, to determine the immunoglobulin's concentration, for the (IgM, IgG and IgA).

**Results:**

Immunoglobulin concentration rates were higher in the immunized subgroup animals compared with those of the control group. The live attenuated vaccine induced highly immune response as compared with killed vaccine. The challenge dose was given to all the animals; the control subgroup animals died while the immunised animals remain alive and healthy.

**Conclusions:**

Intraperitoneal inoculation with live attenuated and killed vaccines induced high immunity against the infection. Live attenuated vaccine was better than the killed vaccine in inducing immunity responses.

**F Rostum Ihsan**

**Faculty of Medicine – Al-Muthanna University**

**Co-Authors: Zeinab, A. Mohammad, Ghazi, M. Al-Khatib**

---

*Preparation of a Vaccine against Diabetic Foot Pathogenic Bacteria using Low Level Laser Irradiation*

**Background:**

Lasers can now be regarded as practical tools with unique properties that have been utilized effectively in several applications in fields of medical and biological sciences in general and in microbiology in particular.

**Objective:**

The aim of the current study was to prepare a vaccine (live attenuated and killed) using irradiation of the bacteria by low level diode laser.

**Materials & Methods:**



Samples were collected from forty patients with diabetic foot infection. The bacterial isolates obtained included the following: *Staphylococcus aureus* (24.59%), *Klebsiella pneumoniae* (22.95%), *Escherichia coli* (21.31%), *S. epidermidis* (9.84%), *Pseudomonas aeruginosa* (9.84%), *Proteus mirabilis* (8.20%), and other species (3.28%). The bacterial isolate sensitivity against a number of antibiotics was examined before irradiation. All demonstrated high resistance to the antibiotics, except two types (Amikacin & Ciprofloxacin) to which the bacterial isolates were sensitive. The bacterial isolates were irradiated with laser using wavelengths (660, 820, and 915nm) to increase their sensitivity culminating at attenuation or killing of the bacteria with increasing exposure times. The attenuated and killed bacteria from each isolate was used to prepare a mixed vaccine. The efficiency of the vaccine was tested using laboratory animals. Fifteen rabbits were used in the current study and they were divided into three groups with five rabbits each: one group for live attenuated vaccine inoculation, another for the killed vaccine, while the third group was used as a control. One month after the completion of the vaccination, the concentrations of the immunoglobulins (IgG, IgA, IgM C3, and C4) in the rabbit serum was measured using Radial Immunodiffusion (RID) method.

## Results:

The results showed significant differences ( $P < 0.001$ ) for the level of IgG between the live attenuated vaccine groups when compared with the control group, and significant differences ( $P < 0.01$ ) for the level of killed vaccine group compared with the control group. The results of IgA concentrations demonstrated significant differences between the three groups: when comparing the attenuated group with control group ( $P < 0.01$ ); between the killed vaccine group and the control group ( $P < 0.05$ ); and for levels of IgM, C3, and C4, when comparing both the live attenuated and killed vaccine groups with the control group, respectively. There were no statistically significant differences between the live attenuated and the killed vaccine groups of all measured concentrations. When subsequently animals were injected with a live dose of the bacterial isolates and the levels of IgM, IgA, IgG, C3, and C4 were measured, similar results as for the vaccination readings were obtained. Finally the animals were injected with the challenge dose of all the isolated live bacteria. Animals in the control group all died, while the immunised animals remain healthy revealing the efficacy of the vaccine.

## Conclusions:

Wavelength (660) nm was the more effective wavelength in killing bacteria; and the variations were not significant between the live attenuated and the killed vaccine.

## Palesa Sekhejane

University of Johannesburg

Co-Authors: Heidi Abrahamse, Nicolette Houeild

---

*Localisation and toxicity of sulfonated zinc phthalocyanine photosensitizer in photodynamic therapy of colorectal adenocarcinoma cells (CaCo-2)*

## Introduction:

Colorectal cancer is the third most commonly diagnosed cancer. Amongst treatments that have been explored, photodynamic therapy (PDT) is a treatment that is of interest as it has advantages such as affinity for cancer cells. This study aimed to determine the localisation site and optimum concentration of photosensitiser in vitro.

## Materials and Methods:

Adenocarcinoma cells (CaCo-2) were grown in minimum essential media and incubated at 37°C, in 5% CO<sub>2</sub> and 85% humidity. Cell concentration of 5x10<sup>4</sup> was used for experimental purposes. The study consisted of three controls i.e. cells that received neither drug nor light (0mm; 0J/cm<sup>2</sup>), light alone (5J/cm<sup>2</sup>), or sensitiser alone. PDT samples received both zinc phthalocyanine at various concentrations (5, 10, 20 or 40µm) and a light dosage of 5J/cm<sup>2</sup> at a wavelength of 680nm. Biological responses were determined 1 and 24h post-irradiation. Photosensitiser localisation was determined by staining cells with fluorescent probes and visualised using fluorescent microscopy. Morphology was visualised using light microscopy. Cell viability, membrane damage and proliferation were determined by trypan blue, lactate dehydrogenase (LDH) and Adenosine triphosphate (ATP) assays, respectively.

**Results:**

Zinc phthalocyanine localized majorly in lysosomes and partially in mitochondria. After 24h, cell swelling was seen in PDT samples treated with 5 and 10mm, whilst in other PDT samples (20 and 40mm) cells had shrunk. There was a significant decrease in cell viability ( $p < 0.001$ ) and increase in LDH ( $p < 0.01$ ) in all PDT treated samples. A significant change ( $p < 0.001$ ) in ATP was noted except in 40mm PDT sample.

**Conclusion:**

Lysosomes are vital organelles for cell disruption; hence zinc phthalocyanine PDT is effective even at lower concentrations, although 20mm appears as an optimum concentration in vitro.

**Sajee Sattyut**

**Lasers in Dentistry Research Group, Khon Kaen University**

---

*LLT for TMD and Oral lesion*

It has been clear that low intensity laser has had a biomodulation-effect. Therefore, this therapy is widely used for pain control and wound healing in oral and maxillofacial region. However, there are still some controversies on the clinical efficacy and repeatability in terms of clinical application. This presentation comprises techniques and regimes based on basic studies, clinical trials and practices as follows: treating temporomandibular disorders using 820nm at 107J/cm<sup>2</sup>, immediate pain relief of aphthous stomatitis using de-focused CO<sub>2</sub> laser irradiating to absorption media and promoting healing of erosive type lichen planus using welding technique by 830nm at 2W. These result clinical efficacies and patients' satisfactions.

**Steve Shanks**

**Erchonia Corporation**

---

*Extensive Review of Low-level laser therapy for non-invasive body contouring***Background:**

Low-level laser therapy (LLLT) is a non-invasive treatment for a wide-assortment of medical ailments. A recent application is for non-invasive body slimming. A Level 1 clinical study was completed and recorded a significant reduction in circumferential measurements across waist, hips, and thighs compared to placebo subjects. Questions remain unanswered to whether the result observed was based upon simple fluid redistribution. The purpose of this retrospective study was to evaluate the efficacy of low-level laser therapy for non-invasive body slimming and determine if the loss was attributable to fluid or fat relocation.

**Methods:**

Data from 689 participants were obtained to evaluate the circumferential reduction demonstrated across the treatment site of the waist, hips, and thighs as well as non-treated systemic regions. Patient data were not pre-selected; all reports provided by clinics using LLLT for body contouring were used to evaluate the efficacy of this treatment. Participants received a total of six LLLT treatments across two-weeks having baseline and post-procedure circumferential measurements recorded. Measurement sites included waist, hips, thighs, arms, knees, neck, and chest.

**Results:**

The mean circumferential reduction reported for the waist, hips, and thighs one week after the treatment regimen was 3.27 inches ( $p < 0.0001$ ). Furthermore, participants demonstrated an overall mean reduction of 5.17 inches across all measurement points 5.17 inches ( $p < 0.0001$ ). Each anatomical region measured exhibited a significant circumferential reduction.

**Conclusion:**

These data reveal that the circumferential reduction exhibited following LLLT is not attributable to fluid or fat relocation as all measurement points, including non-treated regions, reported an inch loss.

## Penny Smalley

AMLA

---

### *Laser Safety: Theory Into Practice*

A universe of laser standards, terminology, regulations, guidelines, professional recommended practices, and policies, has proliferated around the world in an effort to provide standardised governance over the use of Class 3b and Class 4 medical lasers. Healthcare professionals always strive to provide excellence in patient care, and a safe working environment for themselves and their colleagues, but they often feel challenged when required to demonstrate compliance. Interpretation of standards is based on understanding how they are written, what the terminology means, and what is optional, strongly recommended, or mandatory. This paper will discuss the important concepts found in international standards, and what the healthcare practitioner should know about how to interpret and apply those rules to daily practice. International Electrotechnical Commission (IEC) and International Standards Organisation (ISO) documents will be referenced, as the benchmarks for medical laser safety practices.

## Pardis Soleimanzadeh Azar

Laser Research Center in Dentistry, Tehran University of Medical Sciences

Co-Authors: Neda Moslemi, Reza Fekrazad

---

### *Evaluation of Photoactivated Disinfection using Light-Emitting Diode on Bacterial Growth of Aggregatibacter actinomycetemcomitans: an in vitro study*

#### **Background and Aim:**

Aggregatibacter actinomycetemcomitans (A. a) is regarded as the major etiological agent of periodontitis. Eradication of this pathogen is associated with clinical improvement. Previous studies using photoactivated disinfection (PAD) with laser as a light source have shown promising results. More recently, light-emitting diode (LED) devices have been suggested as novel light sources in PAD. These devices are more compact and portable and considerably less expensive and less harmful to the eyes compared to lasers. The aim of this investigation was to evaluate the effects of PAD using LED as the light source on A. a.

#### **Method and Materials:**

Red lighted LED device (FotoSan; CMS Dental, Copenhagen, Denmark; peak wavelength: 630nm, output intensity: 2000-4000mW/cm<sup>2</sup>) was irradiated for 30 seconds, as close as possible to wells containing bacterial solution and photosensitizer (FotoSan agent medium viscosity, FotoSan; CMS Dental, Copenhagen, Denmark; the concentration of active ingredient: 0.1mg/ml). In next group photosensitiser was added to bacterial solution, this time without LED irradiation. In another group, we investigated the effects of LED irradiation on bacterial solution. Each of these groups was compared to a control group that received no other treatment. All groups were cultured in agar medium. After incubation in a semi-oxygenated incubator for 72 hours, colonies were counted.

#### **Results:**

Combination of photosensitiser and light emitting diode irradiation reduced significantly the amount of pathogens. Photosensitiser and irradiation, separately, weren't able to make significant differences from the control group.

#### **Conclusion:**

PAD using a light emitting diode as the light source has reduced aggregatibacter actinomycetemcomitans significantly in the in-vitro condition.



## Jonathan Stone

University of Sydney

Co-Authors: John Mitrofanis

---

### *The helmet experiment: an observation of the mechanism of action of LED-sourced infrared light*

A puzzling feature of reports of low-level infrared treatment of soft-tissue wounds and of degenerating CNS structures is the lack of laterality in the tissue response; the radiation may be applied to one arm or one eye, but the response is bilateral. This has led to suggestions that the high tissue penetrance of infrared light makes it impossible to limit radiation to one side of the body, even in large-bodied species such as humans. Some authors have suggested that low-level infrared treatment has an indirect effect on non-irradiated tissues, as well as a direct effect (the response of the irradiated tissues). We have recently reported that photobiomodulation (LED-sourced low-level red-infrared radiation, PBM) protects midbrain dopaminergic nuclei from the toxin MPTP, used to induce degeneration of these centres in the mouse, as a model of human Parkinson's disease. In those studies the irradiation ( $2\text{J}/\text{cm}^2$ , applied 4 times before, during or following the toxic insult), although intended for transcranial transmission to the brain, reached all of the dorsum of the mice. We have repeated these studies, using a helmet of aluminium foil so that only the body of the mouse caudal to the neck was irradiated. Analysis of the survival of dopaminergic neurones in the substantia nigra pars compacta shows that body-only radiation is effective in protecting dopaminergic centres of the midbrain, although less protective than head-and-body radiation. The protective effect of PBM may be mediated partially by direct, transcranial irradiation of the critical brain tissue, and partially by a systemic or indirect effect, involving quite different mechanisms. The possibility of immune system involvement will be discussed.

## Carla Tim

Universidade Federal de Sao Carlos

Co-Authors: Paulo Bossini, Hueliton Kido, Nivaldo Parizotto, Ana Claudia Renno

---

### *Effects of Low level laser therapy in the process bone repair*

Several resources have been studied in order to accelerate the process of bone repair. Among these low level laser therapy (LLLT) has gained prominence. Studies suggest that LLLT can stimulate osteoblast proliferation and osteogenesis within the fracture site, promoting a greater deposition of bone mass, which is fundamental for the consolidation process. In this context, this study aimed to assess the effects of LLLT on tibial bone defects healing in rats. Sixty male Wistar rats with bilateral tibial defects were randomly distributed into two experimental groups: control or laser-irradiated group. Laser irradiation ( $830\text{nm}$ ,  $100\text{J}/\text{cm}^2$ ,  $30\text{mW}$ ) started immediately after surgery and was performed for 1, 3 and 7 sessions. Animals were sacrificed at 12 hours, 3 and 7 days after surgery. The qualitative histological analysis showed that the laser-irradiated animals presented minor blood clots, intense inflammatory infiltrate and moderate fibrin formation around of the defect when compared with control group at 12 hours post-surgery. Three days after surgery moderate inflammatory infiltrate and highly cellularized granulation tissue was observed only in the laser group. An intense granulation tissue with highly cellularized and newly formed bone was observed in the laser group at 7 days post-surgery. Our findings indicate that laser therapy was able induced to newly formed bone on tibial defects.

## Jan Tuner

Nordic Dental Laser Association

---

### *LLLT in dentistry (and in general) – where do we stand?*

The scientific base for LLLT has improved immensely during the last ten years. In the year 2000 PubMed had some 20 citations, last year some 400. We know much more about the basic mechanisms and the number of positive RCT is well above 100. Dentistry represents a considerable percentage of the available literature and may therefore reflect the general position for LLLT in medicine. The improved evidence for the LLLT effect is seen in the advertising from surgical laser manufacturers, where LLLT indications are often included. The attitude of dentists has moved from scepticism to curiosity.

In spite of the improved situation, however, much remains to be achieved before LLLT reaches a level of Evidence Based Medicine. There are several reasons for this. Ironically, an important drawback is the global effect of LLLT. Although this really is the beauty of the therapy, its many indications lead to a situation where few indications have solid evidence whereas others have only scant evidence. Another drawback is the diverse parameters used in the literature. For example, the literature on TMD is rather encouraging, but each research group has used different laser parameters, application modes and evaluation methods. In addition, the studies involve relatively few patients and observation periods are short. But this is not unique for LLLT. According to an evaluation from The Swedish Council on Health Technology Assessment, the scientific basis for endodontic procedures is extremely poor, the reason being the diversity of treatment methods, small groups of patients and short follow up periods. In spite of this, there are endodontists and professors in the area. Finally, the reporting and understanding of laser parameters in LLLT studies must be improved. And this goes for researchers as well as for reviewers. This presentation will be ended by some examples of new areas in dentistry where LLLT is reported to be useful.

## Jan Tuner

### Nordic Dental Laser Association

---

#### *Treatment of aphthous stomatitis using Low Level Laser Therapy (LLLT)*

An experimental study was carried out on 208 patients with a clinical diagnosis of aphthous stomatitis. Two hundred and fifty two patients were registered and out of these 208 attended the clinic until the ulcers had healed completely. All patients were informed about the parameters of the study and gave their informed consent. One hundred and four patients were selected to receive LLLT (study group) and the remaining 104 received conventional methods (group control) such as topical anesthetics (Lidocaine 2%), diet counselling and oral pain killers. Every other patient of the same type of ulcer was allocated either to study or control group. The laser used was a Lasermed 670DL, 670nm, 40mW. Each ulcer received 1.6J, 2.04J/cm<sup>2</sup>, 51mW/cm<sup>2</sup>, and irradiation from a distance of about 5mm. The patients in the LLLT group were seen on alternating days according to the evolution of the healing. The patients were categorised with regards to type of ulcer and age. Ninety-two of the small ulcers in the LLLT group scarred within 48 hours and the remaining six within 48 hours till four days. In the control group, none of the 92 small ulcers healed within four days. The eight large ulcers in the LLLT group healed within five to seven days while the twelve in the control group healed after more than seven days. The distribution of aphthous stomatitis in the different age groups was found to be in accordance with previous reports in the literature.

## Laurie Walsh

### The University of Queensland

---

#### *Friendly photons: what can be achieved with high level lasers in clinical dental practice*

This workshop will examine stepwise the evolution of thought regarding the use of high level (Class IV) lasers in clinical dentistry, illustrating both common clinical applications and areas where new techniques are emerging which offer faster or less invasive procedures, or reduced requirements for local anaesthesia and better defined clinical endpoints. Today, high level laser therapy is well embedded in clinical dental practice, having first been used for oral surgical procedures (replacing conventional instruments for cutting oral soft tissues and the bones of the jaw), and then for restorative dentistry (removal of dental caries prior to restoration of teeth as a replacement for the high speed drill), and most recently for photothermal disinfection of periodontal pockets and root canals, and photothermal or photodynamic bleaching of discoloured teeth. Studies of the effects of high intensity exposure of tooth structure to laser light have led to new insights into the stability of tooth enamel under conditions of acid exposure, and to new laser treatments for tooth sensitivity and dental erosion. Many studies have shown that under correct exposure parameters, lasers can be used safely in the oral cavity for many common dental procedures, providing benefits to both patients and their treating dental clinicians. The key element for safety is knowing what the unique thermal and non-thermal effects of the chosen wavelength are on the target tissues, and modifying the laser parameters to achieve a more rapid procedure with less total irradiance. Examples will be given of thermal effects of dental laser procedures on the dental pulp or periodontal ligament, and how these can be controlled by careful choice of laser parameters, delivery systems, and by using cooling or heat transfer systems including irrigation.





## Laurie Walsh

The University of Queensland

---

### *Laser dentistry – What the Future Holds*

This lecture will focus on areas where lasers can augment or replace traditional dental treatment approaches. With the major dental conditions being of a microbial nature, great emphasis is placed on how lasers can improve the removal and inactivation of pathogenic bacteria from around and within teeth as well as dental implants and prostheses. Effective laser use requires an appreciation of how laser devices can add to the performance of the clinician and improve the patient outcomes and in-surgery experience without adding unnecessary cost and complexity to the treatment. Examples will be given of how dental caries, periodontal diseases, endodontic and peri-implant infections can be treated with lasers to achieve more predictable outcomes, with specific reference to both high level and low level effects of the irradiating wavelengths. The implementation pathway to establish applications into mainstream clinical practice will also be discussed using examples drawn from general and specialist practice.

## Weixing Yan

Your Healthy GP

Co-Authors: Roberta Chow, Patricia Armati

---

### *Mast cell response to low level visible and infrared laser – evidence of a mechanism for anti-inflammatory and pain relieving effects of low level laser therapy*

#### **Background:**

Low-level laser therapy (LLLT) has been applied in conditions characterised by inflammation and pain for many years. It is unclear, however, what mechanisms contribute to its clinical effect. Mast cells reside in a variety of tissues, e.g. in skin, mucosa and nerve tissues in which mast cells maintain normal functions of immune modulation, repair and regeneration. In this study we focused on laser effects on mast cells, which are important in the generation of both inflammation and pain.

#### **Methods:**

Experiment 1: Mast cells from Sprague Dawley rats were obtained by peritoneal cavity lavage and then purified; cells were irradiated with 650nm, 35mW or 830nm, 450mW continuous wavelength laser for 15 or 30 seconds. Degranulation was then stimulated by compound 48/80 (C48/80). Control cells were not lasered.

Experiment 2: Laser at the same parameters was applied in direct contact with in vivo rat skin, injected with C 48/80 and the skin then biopsied. The number of mast cells and percentage degranulation was then measured and compared with unlasered controls.

Experiment 3: PGE2 levels were also measured in skin biopsies following laser at the same parameters.

#### **Results:**

Experiment 1: Mast cell degranulation induced by C48/80 was inhibited by prior irradiation with 650 or 830nm LLL directly to purified rat peritoneal mast cells (PMC) in vitro.

Experiment 2: the number of mast cells in skin decreased in the site of laser irradiation and percentage of degranulated mast cells was reduced following LLLT when challenged by C48/80.

Experiment 3: PGE2 level in skin decreased after laser irradiation.

#### **Conclusion:**

Both 650 and 808 nm laser irradiation stabilizes mast cells in vitro and in vivo and reduces PGE levels in vivo. This suggests that both anti-inflammatory and pain relieving effects of visible laser and infrared laser at low levels are mediated via mast cell stabilisation and reduction of inflammatory mediators.

## Weixing Yan

Your Healthy GP

Co-Authors: Manasi Gaikwad, Mark Rogers

---

### *New concept, new therapeutic approach to chronic pain*

One out of five Australians, one out of three senior Australians, and more than one-third of the world population suffer from chronic pain. Such persistent pain remains one of the least understood and poorly resourced areas of healthcare. Low level laser therapy (LLLT) has been used clinically for pain relief for decades, with strong evidence of benefit to patients with back and neck pain, headache or migraine. However, the use of LLLT to achieve the most effective pain relief clearly requires more research. A large proportion of musculoskeletal pain is related to soft tissue injuries, which initiate an inflammatory response causing pain, swelling and heat. Conventional medical investigation has no method to definitively diagnose pain, especially chronic pain. CT scan, magnetic resonance imaging (MRI) and ultrasound scan can be used to detect anatomical pathology, however there is no significant clinical correlation between these findings and pain. In our clinical practice, we have introduced and applied thermography, which detects infrared radiation from the vascular bed in skin to detect inflamed tissue and monitor the pain relieving effect of LLLT. Thermograms obtained from patients before, during and after treatment were used to guide selection of the treatment site for LLLT.

This clinical case series found that:

1. soft tissue injury in patients with pain including back pain, neck pain, headache and migraine was detectable by thermography;
2. that infrared LLLT to the site of the injury results in patient's increased perception of heat and pain corresponding to the injured site as detected by thermography;
3. most migraine sufferers have a history of injury, e.g. fall or car accident and the injured site can be visualised by thermography;
4. a patient's posture was improved gradually with pain relief by LLLT.

### **Conclusions:**

Thermography is a feasible and reliable technique to be used in primary practice to diagnose soft tissue injury and inflammation; pain caused by soft tissue injury can be imaged by thermography; a patient's response to infrared LLLT can be used as a clinical marker of inflammation; from our experience a majority of migraine is caused by soft tissue injury and further study is required to develop evidence-based protocols.

## Kenji Yoshida

Department of Oral and Maxillofacial Surgery, School of Dentistry, Aichi-Gakuin University

---

### *LLLT for neuropathy caused by the dental treatment*

Low level laser therapy (LLLT) is currently performed by He-Ne, diode, Nd:YAG lasers and LED. The indications for these modalities in dentistry are sensory paralysis, facial palsy, pain relief of trigeminal neuralgia, temporomandibular disorders and wound healing of oral mucosal ulceration.

When mandibular surgery is conducted such as removal of third molar impacted wisdom teeth, placement of dental implant and other surgery, sometimes the symptoms of paresthesia or neuralgia may occur result in injury of inferior alveolar nerve. To treat those symptoms, administration of Vitamine B12 and/or ATP agents, physical therapy, TENS, photo therapy, LLLT, stellate ganglion blocking, nerve transplantation etc. are selected. However, conventional stellate ganglion blocking is difficult to perform, and failure is frequently seen because of complications such as regional anesthesia intoxication and cardiopulmonary arrest are occasionally observed, we are reported about low level laser irradiation to the near stellate ganglion and mechanisms. The clinical procedure is to press down on the sternocleidomastoid muscle of the ailing contact probe on the skin above the sternoclavicular joint so that it sinks in about 1cm. To assess the effect of low level laser irradiation on the stellate ganglion, the skin temperature of the face



was measured. LLLT is easier to perform and has the additional benefit of being non-invasive. We have good results in treating of neural diseases in dentistry by the application of LLLT, and presented the background of its efficacy and mechanisms.

### Alexander Zimin

**Institute of Cytology, RAS; Russian Research Center for Radiology and Surgical Technology**

**Co-Authors: Gennadiy Zharinov, Kira Samoilo, Natalya Neklasova**

---

*Follow-up results and efficacy of using low power near IR phototherapy in patients with prostate cancer following radiotherapy*

#### **Background:**

There is limited information on survival of patients with cancer after radiotherapy and phototherapy.

#### **Aim:**

To study the effect of phototherapy with nIR laser on incidence of late radiation lesions of urinary bladder and rectum in patients with prostate cancer after distant radiation therapy (DRT) and analysis of 5-year survival rates of these patients.

#### **Material and methods:**

820 patients with PC of I-IV stages were submitted to DRT from January 2000 to June 2009. Patients were divided into the control (n = 455) and the main (n = 365) groups. Patients of the main group were given a 12-day course of phototherapy with the matrix photodiode apparatus Laser Solnyshk (NII EFA, St. Petersburg,  $\lambda = 890\text{nm}$ , 45mW, 10.8J, pulsed-periodic mode, duration of pulses from 120 to 150ns, frequency of pulses from 80 to 3000Hz). Action of light was performed onto the skin areas submitted to DRT beginning with its 12th session. Results: in the control group, frequency of radiation reactions from urinary bladder amounted to 2.6%, whereas in patients of the main group to 0.27% ( $p < 0.05$ ). Frequency of radiation reactions from rectum in control group was 3.73%, while in the main group 1.4% ( $p < 0.05$ ). Added to this, in patients with locally-spread PC the survival analysis revealed a statistically significant difference between the control ( $67 \pm 0.08\%$ ) and main groups ( $89 \pm 0.04\%$ ).

#### **Conclusion:**

In patients with PC after the course of phototherapy with the low power nIR radiation, frequency of radiation lesions of urinary bladder and rectum decreased; also decreased was expression of the degree of these lesions. Moreover, nIR phototherapy did not reduce the survival rates in patients with PC, which could be explained by the positive impact of phototherapy on cell loss factor.

### Alexander Zimin

**Institute of Cytology, RAS; Russian Research Center for Radiology and Surgical Technol.**

**Co-Authors: Gennadiy Zharinov, Kira Samoilo, Natalya Neklasova**

---

*Follow-up results and efficacy of using low power near IR phototherapy in patients with prostate cancer following radiotherapy*

#### **Background:**

Attitudes to phototherapeutic methods using low power visible (VIS) and near IR (nIR) light of lasers, light emitting diodes and other sources are often reserved due to apprehension of their stimulatory effect on tumor growth. There are only a handful of data on the application of phototherapy for prevention and management of complications developing in patients after surgery, chemo- and radiotherapy. It is not widely known that we have a large and positive experience of the application of photoradiations in experimental oncology. The aim of this paper is to review the literature on application of low power VIS and nIR light, in patients with oncological diseases, and in laboratory animals.

#### **Materials and methods:**

This review includes information from databases Medline, Index Medicus, and Russian libraries over the last 25 years. The search string used was as follows: low level laser therapy OR low power laser OR low energy laser OR low intensity light therapy AND cancer.

**Results:**

We have found that VIS and nIR radiations used for treatment of complications in oncological patients after surgery, chemo- and radiotherapy, namely mucositis, skin radiation reactions, local radiation therapy-induced complications in the wound, post operational complications in patients with cancer of gastrointestinal tract, lung and urogenital tract, post-mastectomy syndrome, pre-operational laser therapy of patients with cancer and palliative treatment. Unfortunately, very few papers report follow-up results after treatment with VIS and nIR radiations. However, the experimental data indicate decreased mortality rates, and down-regulation of tumor growth and metastasis dissemination in animals that have transplanted tumours, after exposure to light.

**Conclusion:**

Further studies, with an emphasis on follow-up results, should be carried out before creating clinical protocols.



## Delegate List

First Name	Last Name	Organisation	Suburb/City	Country
Heidi	Abrahamse	University of Johannesburg	Doornfontein	South Africa
Constantin	Ailioaie	Grigore T. Popa University of Medicine and Pharmacy	Iasi	Romania
Luciana	Almeida-Lopes	NUPEN	Sao Carlos	Brazil
Anthony	Ancell	Woollahra Dental Practice	Woollahra	Australia
Juanita	Anders	Uniformed Services University of the Health Sciences	Bethesda	USA
Shahzad	Anwar	Anwar Shah Trust for CP & Paralysis	Lahore	Pakistan
Rob	Auricht	Riverside Veterinary Surgery	Gawler	Australia
Emily	Barr	Your Healthy GP	Hawthorn	Australia
Lusia Minawati	Batiholim	Cosmed Anti Aging & Aesthetic Clinic	Jakarta	Indonesia
David	Baxter	University Of Otago	Dunedin	New Zealand
Maria	Bewcyk	Artarmon Physiotherapy	Artarmon	Australia
Jan	Bjordal	Bergen University College	Bergen	Norway
Melvin	Boldt	QBMI PhotoMedicine	Barneveld	USA
Aldo	Brugnera Junior	World Federation for Lasers in Dentistry		Brazil
Mark	Bruin	THOR Photomedicine Ltd	Chesham	UK
Violet	Bumah	University of Wisconsin-Milwaukee	Milwaukee	USA
James	Carroll	THOR Photomedicine Ltd	Chesham	UK
Charles	Cassar	Australian Medical Laser Association	Adelaide	Australia
Ambrose	Chan	World Federation for Laser Dentistry	Strathfield	Australia
Crystal	Chan	Hoyer Medical Company	Mei Foo	Hong Kong
Jonas	Chan	William Green Pty Ltd	Rydalanere	Australia
Eun Seo	Choi	Chosun University		Korea (South)
Roberta	Chow	Australian Medical Laser Association	Beecroft	Australia
How Kim	Chuan			
Linda	Clark	Artarmon Physiotherapy & Sports Physiotherapy Centre	Artarmon	Australia
Lee	Collins	Westmead Hospital	Wentworthville	Australia
Phillip	Collins	Champion Bay Remedial Massage	Glenfield	Australia
Elizabeth	Croft	Anglican Retirement Villages	Castle Hill	Australia
Vivian	Cury	University of Sao Paulo	Sao Paulo	Brazil
Tina	Czech	Australian Institute of Laser Therapy	Toorak	Australia
Arun	Darbar	Smile Creations Dental Innovations	Leighton Buzzard	United Kingdom
Chitra	Das	Divine Smiles	Brisbane	Australia
Ram	Das	Divine Smiles	Brisbane	Australia
Dariusz	Dayer	Iranian Medical Laser Association	Tehran	Iran
Alain	Dijkstra	Medlaser Equipment Industrial Limited	Shenzhen	China
Gary	Dyer	Hart's Health Consulting Services	Port Willunga	Australia
Janis	Eells	UW-Milwaukee Biomedical Sciences	Milwaukee	USA
Zhen Feng Clement	Eng	Q & M Dental Centre		Singapore
Chukuka	Enwemeka	University of Wisconsin-Milwaukee	Milwaukee	USA
Reza	Fekrazad	Iranian Medical Laser Association	Tehran	Australia
Cleber	Ferraresi	Federal University of St Carlos	St Carlos	Brazil
Lea	Foster		Casino	Australia
Manasi	Gaikwad	Your Healthy GP	Parkside	Australia
Roy	George	School of Dentistry and Oral Health, Griffith University	Southport	Australia
Mohammad Kazem	Ghavidel Shahrabaki	Iranian Medical Laser Association		Iran
Richard	Godine	Ruckersville Animal Hospital	Ruckersville	USA
Bruce	Griffiths	Biomedical Technology Services	Woolloongabba	Australia
Michael	Hamblin	Wellman Center for Photomedicine, Mass General Hospital	Boston	USA



# THE SPECTRUM OF LASER – TRANSLATING BASIC RESEARCH TO CLINICAL OUTCOMES

First Name	Last Name	Organisation	Suburb/City	Country
Andrea	Hart	Hart's Health Consulting Services	Port Willunga	Australia
Alan	Harvey	Acupak	Hawthorn East	Australia
Dianne	Hermans	Neuromagnetics Australia Pty Ltd	Cleveland	Australia
James	Hermans	Neuromagnetics Australia Pty Ltd	Cleveland	Australia
Gunhild	Hinchey	The St. George Hospital	Sydney	Australia
Ron	Hirschberg	Brockton Animal Hospital LLC	Brockton	USA
Lars	Hode	Swedish Laser-Medical Society		Sweden
Andrew	Hollo	Cooper Street Clinic	Vaucluse	Australia
Nicolette	Hourelid	University of Johannesburg	Johannesburg	South Africa
David	Isaacs	David H Isaacs Pty. Ltd.	North Sydney	Australia
Insoo	Jang	Woosuk University	Jeonju	Korea (South)
Molly	Jenkins	SpectraVET, Inc	Lawndale	USA
Peter	Jenkins	Spectra-Medics Pty Ltd	Oakbank	Australia
Hee Young	Jeong- Ancell	Woollahra Dental Practice	Woollahra	Australia
Martin	Jodlowski-Tan		Glossodia	Australia
Timothy	Johnston	Paediatric Dentist	West Perth	Australia
Stefan	Jordison	Irradia AB		Sweden
Shirley	Kan	Konftec Corporation	Sijh District	Taiwan
Milad	Karamlou	Shahid Beheshti University Of Medical Sciences	Toronto	Canada
Anita	Karki Chetry	Your Healthy GP	Sydney	Australia
Tiina	Karu	Laser Technology Research Centre of Russian Academy of Science		Russia
Evette	Kellie	William Green Pty Ltd	Rydalanere	Australia
ByungKuk	Kim	Chonnam National University, School of Dentistry	Bug Gu	Korea (South)
Ji Sun	Kim	Chonnam National University, School of Dentistry	Bug Gu	Korea
Ok Joon	Kim	Chonnam National University, School of Dentistry	Bug Gu	Korea (South)
Slava	Kim	BioFlex Laser	Toronto	Canada
Zoltan	Kocsi	Bendor Research	Lyneham	Australia
Mallika	Kumar	Your Healthy GP	Parkside	Australia
Liisa	Laakso	Australian Medical Laser Association	Gold Coast	Australia
Marjan	Lajevardi	Ajman University	Fujairah	United Arab Emirates
Antonio	Lauto	University of Western Sydney, Marcs Institute	Penrith	Australia
Ernesto Cesar	Leal Junior	Nove de Julho University	Sao Paulo	Brazil
Robert	Legris	Weber Medical Canada	Cagary	Canada
Ann	Liebert	Artarmon Physiotherapy	Artarmon	Australia
Won Bong	Lim	Chonnam National University, School of Dentistry	Bug Gu	Korea (South)
Hong Sai	Loh	World Federation for Laser Dentistry WFLD		Singapore
Kevin	Lowe		Bondi Junction	Australia
Jerianne	Lyons	University of Wisconsin-Milwaukee	Milwaukee	USA
Ileene	Macdonald	Main Road Clinic	Diamond Creek	Australia
Gholamreza	Majlesi Koupaei	Private	Isfahan	Iran
Stuart	McComb	Elusor Pty Ltd - Pulse Laser Relief	Roseville	Australia
Geoffrey	Melman	University of the Witwatersrand	Sandton	South Africa
Daiane	Meneguzzo	ST Leopoldo Mandic	Campinas	Brazil
Graham	Merry	Photospectra Health Sciences	Toronto	Canada
Nenad	Milovanovic	Clinic for Rehabilitation Medical Schoo	Belgrade	Yugoslavia
Len	Mioceovich		Kardinya	Australia
Shigeyuki	Nagai	Nagai Dental Clinic	Shinagawa	Japan
Raj	Nair	Griffith University and Queenslnd Health	Southport	Australia
Ernesto	Nickel	RJ - Laser, Reimers & Janssen GmbH		Germany
Anders	Nobel	Irradia AB		Sweden
Poliani	Oliveira	Federal University of Sao Carlos	Sao Carlos	Brazil



## Delegate List

First Name	Last Name	Organisation	Suburb/City	Country
Koe Ean	Ong	ADA NT	Casuarina	Australia
Uri	Oron	Tel-Aviv University	Tel-Aviv	Israel
Marisa	Packer	Your Healthy GP	Parkside	Australia
Milena	Palazon	University of Sao Paulo	Cidade Univers	Brazil
Shikha	Parmar	Your Healthy GP	Hawthorn	Australia
Janice	Payne	Alchemy at Mt Keira	Dapto	Australia
Rajan	Payyappilly	Calamvale Family Practice	Labrador	Australia
Neil	Piller	Department of Surgery, School of Medicine, Flinders University	Bedford Park	Australia
Brian	Pryor	LightForce Therapy Lasers by LiteCure Medical	Newark	De
Jaimini	Raniga	Your Healthy GP	Sydney	Australia
Fariborz	Razban	Private Practice	Melbourne	Australia
Meikin Li	Rees	Laser Therapy Centre	Sydney	Australia
Philip	Rees	Laser Therapy Centre	Sydney	Australia
Werner	Reimers	RJ - Laser, Reimers & Janssen GmbH		Germany
Ian	Relf	University of Melbourne	Carlton	Australia
Shimon	Rochkind	Tel Aviv Sourasky Medical Center	Tel Aviv	Israel
Natalia	Rodrigues	Federal University of Sao Carlos	Sao Carlos	Brazil
Mark	Rogers	Your Healthy GP	Parkside	Australia
Hans	Romberg	Medizintechnik	Stutensee	Germany
Gerry	Ross	Private practice	Tottenham	Canada
Robyn	Salau	Wagga Bowen & Laser Clinic	Mangoplah	Australia
Sajee	Sattiyut	Lasers in Dentistry Research Group, Khon Kaen University	Khon Kaen	Thailand
Robin	Schumacher	QBMI PhotoMedicine	Barneveld	USA
John	Shanks	Erchonon Corporation	Mckinney	USA
Steven	Shanks	Erchonon Corporation	Mckinney	USA
Penny	Smalley	Australian Medical Laser Association	Chicago	USA
Jason	Smith	LightForce Therapy Lasers by LiteCure Medical	Newark	De
Jenny	Sohn	Your Healthy GP	Parkside	Australia
Hamid	Soleiman			Iran
Pardis	Soleimanzadeh Azar			
Grace	Sun		Los Angeles	USA
Ratnawati	Suwargo		Jakarta Barat	Indonesia
Clark	Tedford	PhotoThera, Inc.	Carlsbad	
Mark	Teng	AMAC NSW	Ashfield	Australia
Emily	Teo	Emily Teo Medical Acupuncture	Gordon	Australia
Lars	Thorselius	Sodra laserklinen	Enskede	Sweden
Sharon	Tilley	Lymphoedema And Laser Therapy	Glenside	Australia
Carla Roberta	Tim	Federal University of St Carlos	St Carlos	Brazil
Jan	Tunér	Nordic Dental Laser Association	Gregesberg	Sweden
Krisztina	Valter	Medical School, The Australian National University	Acton	Australia
Lucy	Van Baalen	AMAC	Lambton	Australia
Euahna	Varigos	Private	East Melbourne	Australia
Gordon	Waddington	University of Canberra	Bruce	Australia
Laurence	Walsh	The University of Queensland	Brisbane	Australia
Kate	Williams	Tasmanian Lymphoedema & Laser Centre	St Marys	Australia
Dan	Xu	Medlaser Equipment Industrial Limited	Shenzhen	China
Weixing	Yan	Your Healthy GP	Sydney	Australia
Marlene	Yee	Medical Practitioner	Carlingford	Australia
Kenji	Yoshida	School of Dentistry, Aichi-Gakuin University	Nagoya City	Japan
Cath	Young	Griffith University	Springbrook	Australia
Ching	Yu Lin	RJ - Laser, Reimers & Janssen GmbH		Taiwan





yourhealthy  .com

# DO YOU SUFFER FROM MIGRAINES, TINNITUS, CHRONIC PAIN OR BACK PAIN? AN OLD INJURY?

As seen on "A Current Affair" and "Today Tonight"; Your Healthy GP is now in Adelaide, Melbourne and Sydney offering;

- Cold Laser Therapy • Comfortable Treatment
- Infra-red Low Level Laser • Non Invasive
- Non-Surgical • Pain Free • High Success Rate



Call today for an appointment or more detailed information!

## **Sydney**

02 9252 2225  
Level 11, 8 Spring Street,  
Sydney, NSW 2000

## **Adelaide**

08 8299 9111  
12 Glen Osmond Road  
Parkside, SA 5063

## **Melbourne**

03 9824 6338  
12 Cato Street  
Hawthorn East, VIC 3123