

Low-Level Light Therapy: Photobiomodulation

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Low-Level Light Therapy: Photobiomodulation

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Introduction to the Series

Since its inception in 1989, the Tutorial Texts (TT) series has grown to cover many diverse fields of science and engineering. The initial idea for the series was to make material presented in SPIE short courses available to those who could not attend and to provide a reference text for those who could. Thus, many of the texts in this series are generated by augmenting course notes with descriptive text that further illuminates the subject. In this way, the TT becomes an excellent stand-alone reference that finds a much wider audience than only short course attendees.

Tutorial Texts have grown in popularity and in the scope of material covered since 1989. They no longer necessarily stem from short courses; rather, they are often generated independently by experts in the field. They are popular because they provide a ready reference to those wishing to learn about emerging technologies or the latest information within their field. The topics within the series have grown from the initial areas of geometrical optics, optical detectors, and image processing to include the emerging fields of nanotechnology, biomedical optics, fiber optics, and laser technologies. Authors contributing to the TT series are instructed to provide introductory material so that those new to the field may use the book as a starting point to get a basic grasp of the material. It is hoped that some readers may develop sufficient interest to take a short course by the author or pursue further research in more advanced books to delve deeper into the subject.

The books in this series are distinguished from other technical monographs and textbooks in the way in which the material is presented. In keeping with the tutorial nature of the series, there is an emphasis on the use of graphical and illustrative material to better elucidate basic and advanced concepts. There is also heavy use of tabular reference data and numerous examples to further explain the concepts presented. The publishing time for the books is kept to a minimum so that the books will be as timely and up-to-date as possible. Furthermore, these introductory books are competitively priced compared to more traditional books on the same subject.

When a proposal for a text is received, each proposal is evaluated to determine the relevance of the proposed topic. This initial reviewing process has been very helpful to authors in identifying, early in the writing process, the need for additional material or other changes in approach that would serve to strengthen the text. Once a manuscript is completed, it is peer reviewed to ensure that chapters communicate accurately the essential ingredients of the science and technologies under discussion.

It is my goal to maintain the style and quality of books in the series and to further expand the topic areas to include new emerging fields as they become of interest to our reading audience.

*James A. Harrington
Rutgers University*

Contents

<i>Preface</i>	xv
<i>List of Contributors</i>	xvii
1 Introduction	1
1.1 General	1
1.2 Light Sources	3
1.3 Physics and Tissue Optics	5
1.4 Irradiation Parameters	7
1.5 Penetration Depth	9
1.6 Research in PBM/LLLT	12
1.7 Present Status	13
1.8 Clinical and Biomedical Applications of PBM	14
References	17
2 History of LLLT and Photobiomodulation	21
2.1 History of Photomedicine	21
2.2 Development of the Laser	25
2.3 Discovery of Photobiomodulation	31
References	33
3 Molecular Mechanisms of LLLT	37
3.1 Chromophores	37
3.1.1 Cytochrome c oxidase	37
3.1.2 Retrograde mitochondrial signaling	37
3.1.3 Light-sensitive ion channels	38
3.1.4 Direct cell-free light-mediated effects on molecules	40
3.2 Signaling Molecules	40
3.2.1 Adenosine triphosphate	40
3.2.2 Cyclic AMP	41
3.2.3 Reactive oxygen species	41
3.2.4 Calcium	42
3.2.5 Nitric oxide	42
3.3 Activation of Transcription Factors	42
3.3.1 Nuclear factor kappa B	42

3.3.2	RANKL	43
3.3.3	Hypoxia-inducible factor	44
3.3.4	Akt/GSK3 β / β -catenin pathway	44
3.3.5	Akt/mTOR/CyclinD1 pathway	45
3.3.6	ERK/FOXO1	46
3.3.7	PPAR γ	46
3.3.8	RUNX2	46
3.4	Effector Molecules	47
3.4.1	Transforming growth factor	47
3.4.2	Oxidative stress	47
3.4.3	Pro- and anti-inflammatory cytokines	47
3.4.4	Brain-derived neurotrophic factor	48
3.4.5	Vascular endothelial growth factor	48
3.4.6	Hepatocyte growth factor	49
3.4.7	Basic fibroblast growth factor and keratinocyte growth factor	49
3.4.8	Heat-shock proteins	49
	References	50
4	Cellular Mechanisms	57
4.1	Inflammation	57
4.2	Cytoprotection	58
4.3	Proliferation	59
4.4	Migration	59
4.5	Protein Synthesis	60
4.6	Stem Cells	60
	References	60
5	Tissue Mechanisms	63
5.1	Muscles	63
5.2	Brain	63
5.3	Nerves (Repair and Pain)	64
5.4	Healing (Bones, Tendons, and Wounds)	65
5.5	Hair	66
5.6	Skin	67
5.7	Fat	68
5.8	High-Fluence Low-Power Laser Irradiation	69
	References	70
6	Biphasic Dose Response	75
6.1	Dose Dependence and Dose Rate Effects: The Biphasic Curve	75
6.2	Biphasic Response: Irradiance	76
6.3	Biphasic Response: Time or Energy Density	78
6.4	Beam Measurement Reporting Errors	78
6.5	Biphasic LLLT Dose Response Studies	79
6.5.1	<i>in vitro</i> activation of NF- κ B	79

6.5.2	Mouse wound healing	80
6.5.3	Rat arthritis	81
6.6	Possible Explanations for Biphasic Dose Response in LLLT	82
6.6.1	Excessive ROS	82
6.6.2	Excessive NO	82
6.6.3	Activation of a cytotoxic pathway	83
6.7	Summary and Conclusion	83
	References	84
7	Pre-conditioning	89
7.1	Introduction	89
7.2	Mechanisms of IPC	90
7.3	Other Modalities for Pre-conditioning	91
7.4	Similarities between IPC and LLLT	93
7.5	Skeletal Muscle Pre-conditioning through Light	93
7.6	Improving Inflammation and the Analgesic Effect	96
7.7	Reducing Damage after Heart Attack	100
7.8	Protecting Cells from Toxins	102
7.9	Wound Healing	103
7.10	Central Nervous System	103
7.11	Protecting Skin from Ultraviolet Damage	104
7.12	Conclusion	106
	References	107
8	Low-Level Laser Therapy and Stem Cells	117
	<i>Qi Zhang, Tingting Dong, and Chang Zhou</i>	
8.1	Effects of LLLT on Stem Cells	117
8.1.1	Hematopoietic stem cells	117
8.1.2	Mesenchymal stem cells	119
8.1.3	Adipose-derived stem cells	120
8.2	Clinical Applications of LLLT for Stem Cells	120
8.2.1	Stem-cell transplantation	120
8.2.2	Wound healing and skin restoring	121
8.2.3	Neural regeneration	121
8.2.4	Treating hair loss	122
	References	122
9	Edema and Lymph Flow	131
	References	133
10	Augmenting Wound Healing with Photobiomodulation Therapy	135
	<i>Asheesh Gupta</i>	
10.1	Introduction	135
10.2	Light-Based Healing Therapy: Photobiomodulation	136
10.3	Mechanisms of PBM Action	138

10.4	PBM Therapy for Acute and Chronic Wound Healing	140
10.4.1	Acute wound healing	140
10.4.2	Chronic wound healing	141
10.5	Pre-conditioning with PBM Therapy before Surgery	142
10.6	Conclusions and Future Perspectives	142
	References	143
11	Photobiomodulation in Human Muscle Tissue for Better Sports Performance	147
11.1	Introduction	147
11.2	Literature Review	148
11.2.1	Acute responses in exercises with <i>biceps brachii</i> muscles	148
11.2.2	Acute responses in exercises with <i>quadriceps femoris</i> muscles	156
11.2.3	Acute responses during exercise on a treadmill	158
11.2.4	Chronic responses in clinical trials	160
	References	163
12	Photobiomodulation in Bone: Studies <i>in vitro</i>, <i>in vivo</i>, and Clinical Applications	169
	<i>Cleber Ferraresi, Fernanda Freire, and Michael R. Hamblin</i>	
12.1	Photobiomodulation in Bone	169
12.2	<i>in vitro</i> Studies with Bone Cells	171
12.3	Bone Injury in Animal Models	173
12.3.1	Laser versus ultrasound	174
12.3.2	Osteoporotic rats	175
12.3.3	Biomaterials	175
12.3.4	Gene expression	176
12.3.5	Diabetic rats	177
12.4	Bone Healing in Clinical Trials	178
	References	179
13	Photobiomodulation in Cartilage: <i>in vitro</i>, <i>in vivo</i>, and Clinical Trials	183
	<i>Cleber Ferraresi, Fernanda Freire, and Michael R. Hamblin</i>	
13.1	Photobiomodulation in Cartilage	183
13.2	<i>in vitro</i> Studies with Cartilage-Related Cells	184
13.3	Cartilage Injury in Animal Models	185
13.3.1	Osteochondral injury	185
13.3.2	Arthritis and osteoarthritis	186
13.4	Cartilage Healing in Clinical Trials: Arthritis and Osteoarthritis	189
	References	192
14	Photobiomodulation in Tendons: Effects <i>in vitro</i>, <i>in vivo</i>, and Clinical Use	195
	<i>Cleber Ferraresi, Fernanda Freire, and Michael R. Hamblin</i>	
14.1	Photobiomodulation in Tendons	195

14.2	<i>in vitro</i> Studies with Tendon Cells	196
14.3	Achilles Tendon Injury in Animal Models	197
14.3.1	Achilles tendon healing in diabetic rats	200
14.4	Tendon Healing in Clinical Trials	201
	References	202
15	Dermatology and Aesthetic Medicine Applications	205
15.1	Effects of LLLT on Skin	205
15.1.1	Skin rejuvenation	205
15.1.2	Acne	209
15.1.3	Herpes virus infections	210
15.1.4	Vitiligo	212
15.1.5	Pigmented lesions	213
15.1.6	Hypertrophic scars and keloids	214
15.1.7	Burns	215
15.1.8	Psoriasis	216
15.2	LLLT for Treatment of Hair Loss	218
15.2.1	Hair and types of hair loss	218
15.2.2	Existing treatments	220
15.2.3	Androgenetic alopecia	222
15.2.4	Alopecia areata	224
15.2.5	Chemotherapy-induced alopecia	224
15.3	LLLT for Fat Reduction and Cellulite Treatment	225
15.3.1	Lipoplasty and liposuction	225
15.3.2	Fat reduction and cellulite treatment	225
15.3.3	Combination treatments including LLLT	226
15.3.4	LLLT for treating cellulite	227
15.4	Conclusion	228
	References	228
	Bibliography	241
16	Dental Applications	243
16.1	Musculoskeletal Pain: Temporal Mandibular Joint Disorder	243
16.2	Neuropathic Pain	244
16.3	Post-extraction Pain, Swelling, and Trismus	245
16.4	Nerve Injuries	245
16.5	Orthodontic Pain	246
16.6	Orthodontic Tooth Movement	246
16.7	Dentine Hypersensitivity	247
16.8	Herpes Simplex Infection	247
16.9	Cancer Therapy Side Effects	248
16.10	Post-operative Wound Healing	248
16.11	Endodontics	248
16.12	Analgesia	249

16.13 Lichen Planus	249
16.14 Stem Cells	250
References	250
17 LLLT Treatment of Pain: Clinical Applications	255
<i>Roberta Chow</i>	
17.1 Background	255
17.2 Pain	255
17.3 Types of Pain and Mechanisms	256
17.4 Mechanisms Underlying Pain Relief	257
17.4.1 Neural blockade	257
17.4.2 Reduced inflammation	257
17.4.3 Reduced edema	258
17.4.4 Reduced muscle spasm	259
17.4.5 Tissue repair	259
17.4.6 Release of neurotransmitters	260
17.5 Conditions in which LLLT is Used, and Evidence	260
17.5.1 Reviews of LLLT and pain	260
17.5.2 Evidence for specific conditions	260
17.5.2.1 Knee osteoarthritis	260
17.5.2.2 Hand osteoarthritis and rheumatoid arthritis	261
17.5.2.3 Gout and other crystallopathies	261
17.5.2.4 Neck pain	262
17.5.2.5 Back pain	262
17.5.2.6 Shoulder pain	263
17.5.2.7 Tendinopathy and enthesitis	263
17.5.2.8 <i>Lateral epicondylitis</i>	263
17.5.2.9 Trigger point and myofascial pain	264
17.5.2.10 Neuropathic pain	264
17.5.2.11 Lymphedema	265
17.5.2.12 Post-operative pain	265
17.6 Pre-treatment Pain Relief	266
17.7 Unique Effects of LLLT on Pain	266
17.8 Practical Considerations	267
17.8.1 Example: treating knee osteoarthritis	267
17.8.2 Factors influencing outcomes	268
17.9 Laser Factors	269
17.9.1 Wavelength	269
17.9.2 Correct dose	269
17.9.3 Application technique	269
17.9.4 Treatment protocol	270
17.9.5 Length of treatment	270
17.10 Patient Factors	270
17.11 Disease Factors	271

17.12 Goals of Treatment	271
17.12.1 Monotherapy versus adjunctive treatment	271
17.13 Patients Unresponsive to LLLT	272
17.14 Practice Points	272
17.15 “Tip of the Iceberg” Principle	273
17.16 Prognostic Factors	273
17.17 Side Effects of Treatment	273
17.18 Conclusion	274
References	274
18 Applications to the Central Nervous System	287
18.1 Mechanisms of Photobiomodulation in the Central Nervous System	287
18.2 Human-Skull Transmission Measurements	289
18.3 PBM for Stroke	290
18.3.1 Stroke	290
18.3.2 PBM application	294
18.3.3 PBM for stroke in animal models	294
18.3.4 Clinical trials for acute stroke	297
18.4 PBM for Traumatic Brain Injury	297
18.4.1 Introduction	297
18.4.2 Studies of PBM for TBI in mice	299
18.4.3 Effect of different laser wavelengths in PBM for TBI	300
18.4.4 Effect of pulsing PBM for TBI	302
18.4.5 Effects of PBM regimen for TBI	303
18.4.6 PBM has more effect on IEX knockout mice	304
18.4.7 PBM in combination with metabolic inhibitors	304
18.4.8 PBM increases neuroprogenitor cells	304
18.4.9 PBM increases BDNF and synaptogenesis	305
18.4.10 PBM in humans with TBI	305
18.5 PBM for Neurodegenerative Diseases	307
18.5.1 Neurodegenerative diseases	307
18.5.1.1 Parkinson’s disease	307
18.5.1.2 Alzheimer’s disease	307
18.5.1.3 Amyotrophic lateral sclerosis	308
18.6 PBM for Psychiatric Disorders	308
18.7 Conclusion	309
References	309
19 Intravascular Laser Irradiation of Blood	319
<i>Daiane Thais Meneguzzo, Leila Soares Ferreira, Eduardo Machado de Carvalho, and Cássia Fukuda Nakashima</i>	
19.1 Introduction	319
19.2 History of ILIB	319
19.3 Antioxidant Action of ILIB	321

19.4	Modified ILIB Techniques	322
19.4.1	Intranasal irradiation	322
19.4.2	Wrist skin irradiation	322
19.5	ILIB Side Effects and Contraindications	324
	References	324
20	Future Directions and the Path Forward	331
20.1	Disappointment at Current Lack of Progress	331
20.2	New Indications	331
20.2.1	Stem cells	331
20.2.2	Transcranial LLLT for brain disorders	332
20.2.3	Ophthalmology	333
20.2.4	Autoimmune diseases	334
20.2.5	Lung disease	334
20.2.6	Performance enhancement	335
20.3	New Light Sources	335
20.3.1	Wearable LLLT devices: bandages and clothing	336
20.3.2	Implantable LEDs for brain and spine	336
20.3.3	Swallowable battery-powered LED capsule for GI diseases	337
20.4	Marketing Hype	337
20.5	Negative Publication Bias	338
20.6	The Path Forward	338
	References	339
	Appendix: Review of LLLT Applications	345
	<i>Index</i>	365

Preface

For almost 50 years, the medical therapy formerly known as “low-level laser therapy” and now known as “photobiomodulation” has had a somewhat checkered history. This approach has been promoted by some of its aficionados with almost missionary zeal, while doubters and skeptics have regarded it as “junk science” and “alternative and complementary medicine.” This Tutorial Text intends to convey to the contemporary scientific reader that photobiomodulation is becoming increasingly well-founded based on the accepted principles of photochemistry, cellular and molecular biology, and physiology.

The text covers in some detail the basic mechanisms of action of photobiomodulation at the cellular and molecular level because we have found that by far the question posed most often by scientists outside the field is “How does it really work?” The well-known biphasic dose response is covered because we believe that failure to take account of this phenomenon contributes to many of the negative studies that have been published. The ability of photobiomodulation to be used as a pre-conditioning regimen before some medical or surgical procedure or for performance enhancement is intriguing.

This Tutorial Text (larger than most) includes original and previously published material. The majority of the book focuses on a critical analysis of the various diseases and disorders of different human and animal tissue and organ systems that can be beneficially treated by photobiomodulation therapy. Chapters cover well-established applications in muscles and orthopedic conditions (bone, tendon, cartilage). Applications of photobiomodulation in dentistry have historically been important because dentists are accustomed to using lasers and light sources in their clinical practice. In addition to the foregoing, more systemic disorders are addressed, such as stem cells, lymph flow and edema, and laser irradiation of blood. One of the most important growing areas of medical application is photobiomodulation to the brain. Many common disorders—such as stroke, traumatic brain injury,

psychiatric diseases, and dementia—may all benefit. Finally, one of the commercially successful areas of photobiomodulation involves its applications to aesthetic medicine, including skin appearance, hair regrowth, and fat removal.

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