Phototherapy, (combining laser therapy and therapy with other light sources, such as light-emitting diodes, LEDs) is now applied in Sports Medicine with the objectives of not only the diagnosis of and treatment for sports related diseases and disorders, but also improvement of physical strength and the autoimmunological system, leading to an enhancement of each individual athlete’s ability, skill, and capacity in their own particular field. As the rise of interest in sports increases dramatically, so have the injuries, and so has the number of occasions that we reconstructive surgeons find ourselves treating such injuries. The area of sports injuries which we cover extends from facial soft tissue trauma, facial bone fractures, and hand surgery to post-contusion skin necrosis, ulcers, skin soft tissue deficiency and bone deficiency. Low level laser therapy (LLLT) has areas in which its efficacy is already well-documented, like pain attenuation, promotion of wound healing, activation of blood flow and so on. From my own research and clinical applications, some of which are précised here, I have shown that LLLT stimulates local blood flow in flaps, can rescue failing grafts and flaps, heal a large variety of recalcitrant ulcers and remove pain in temporomandibular joint injury. Furthermore, the actions and reactions associated with laser therapy have been proved to promote the living body to use its inherent powers of healing and recuperation to bring itself back to a normal condition, the theory of laser homeostasis. Recent spin-offs from the NASA space medicine program have included a new generation of LEDs, vastly more powerful, stable and with quasimonochromatic outputs that have enables their clinical application in almost every field where laser therapy has proved effective, but at a fraction of the cost of laser diodes. My hope is that active therapeutic application of light, either from laser systems, LED systems or a combination of both of them, will enable everybody including sports professionals and amateurs to lead healthy lives, with a higher quality of life, and to enjoy sports throughout their lifespan.

Key words: Phototherapy, laser therapy, sports medicine, recalcitrant ulcers, temporomandibular joint pain

Introduction

As the rise of interest in sports increases dramatically, so have the injuries, and not only in contact sports.(1) Phototherapy, combining in its widest sense laser surgery, laser therapy and light emitting diode (LED) therapy is currently applied in sports medicine with the objectives of not only diagnosis and treatment of sports-related diseases and disorders, and attenuation of pain,(2) but also to help improve the physical strength and fortify the autoimmunological system of the athlete, professional or amateur. Acute exercise has been correlated with a lowering of the autoimmune function through excessive production of reactive oxygen species, but LLLT has been shown to decrease the ROS production. The judicious use of phototherapy could therefore lead to an enhancement of each athlete’s ability, skill and capacity in their own special field.

In my work as a reconstructive surgeon, I have been involved in treating patients suffering from congenital deformities (craniofacial malformation, cleft lip and palate, facial deformity, chest deformity and congenital deformities of both hand and foot); trauma (facial injury, hand injuries, burns, et cetera); head and neck tumours; skin cancers; reconstructive surgery of tissue defects; aesthetic surgery; and surgery for a wide variety of cutaneous lesions. We carry out our work based on the concept that we are helping and supporting patients to return to as normal a life as possible following the occurrence of their accident and acquired deformity, by reconstructing both the morphology and function of the damaged area. The surgical laser has applications here, In sports medicine, this aim is fine-tuned according the different levels of training achieved by the injured professional and amateur with the final goal of getting the participant back into competition, training or amateur participation. Laser therapy has a long pedigree in the
treatment for musculoskeletal pain and soft tissue injuries, and LED therapy was recently reported as effective in removing sports injury-related pain and postoperative pain following surgery. Phototherapy in its narrower sense, i.e., excluding the surgical applications of the laser, is ideally suited to treating soft tissue trauma and musculoskeletal pain, restoring good blood flow to vascularly compromised areas, and helping accelerate and improve the process of wound healing and repair following sports-related injuries.

Early days
At first, when I started work in my chosen field of plastic and reconstructive surgery, I was mainly involved with treatment for congenital cutaneous lesions, such as haemangiomas and other members of the blood malformation group of naevi, Ohta’s naevus and other members of the melanin anomaly group, various other pigmented and nonpigmented lesions, both congenital and acquired. To treat these, I used laser surgery, or high reactive-level laser applications. In parallel with this I became very interested in the development of the laser instruments themselves, and worked in tandem with laser manufacturers to develop instrumentation for specific applications, without, I am sorry to say, making any great advances in this area.

In the late 1970’s I heard about the development of a new type of laser treatment, involving the possible use of low incident levels of laser energy to treat severe skin ulcers. I further discovered that this modality, which became recognized internationally as low level laser therapy, following the terminology established by Ohshiro and Calderhead, was effective in pain attenuation, with many of the mechanisms and pathways having now been elucidated. I will refer to this modality as ‘laser therapy’, as distinct from ‘laser surgery’. One of the mechanisms of specific interest was enhanced blood flow in and around the irradiated area. Bearing this in mind, I wondered if this laser application could have any potential indications in skin flap and graft surgery, which are very frequent procedures in the field of reconstructive surgery. This was the starting point for our studies under the advice of Dr Toshio Ohshiro, one of the real pioneers in laser treatment and research.

Specific Indications of Laser Therapy
I would now like to examine some specific indications of laser therapy which have important bearing on its use and potential use in sports medicine and surgery.

Laser therapy and skin flaps
Skin flaps absolutely demand good blood flow through revascularization and neovascularization in order for the flap to survive without necrosis. If any problem occurs which, for whatever reason, obstructs or occludes the flap’s blood supply, it is inevitable that the skin flap will gradually turn necrotic, and finally die. If this condition could be improved, it would allow us to have more choice as far as the form of secondary reconstruction methodology.

I therefore started some studies which were aimed at elucidating the methods of preventing or reducing these blood flow problems with the use of laser therapy, using semiconductor diode lasers. My first study was on random caudal flaps in the rat model. There were three groups of animals: the experimental group which were treated with a gallium aluminium arsenide (GaAlAs) laser delivering 60 mW in continuous wave at 830 nm in the near infrared; a second group irradiated with a noncoherent light-emitting diode (LED) at a nominal 840 nm, and adjusted to deliver the same dose; and the unirradiated control group. In all three groups the random caudal flaps were raised and immediately sutured back in place. Each animal in the laser therapy and LED group then received a single dose of 10 J/cm² of their respective modality (Table 1). The control group were handled in exactly the same way, but received no laser irradiation.

Relatively short term fluorescein angiography was performed to assess the degree of blood perfusion of the flaps in a set of animals from all three groups. In another set of animals, transillumination of excised skin specimens was used to qualify and quantify the number of blood vessels, their diameter and density. In a third set of animals, flap take was measured by assessing the area of flap survival and necrosis.

The results were quite conclusive. In that first experiment, and indeed in many others repeated by myself and other independent groups of workers, I was able to demonstrate clearly that the diode laser-irradiated flaps demonstrated better early stage perfusion (Figure 1), better angiogenesis as shown by transillumination (Figure 2) and a greater area of flap survival than either the LED-irradiated specimens (same wavelength, same dose, but noncoherent light) or the unirradiated controls (Figure 3), while there was no statistically signifi-

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Diode laser</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>830 nm</td>
<td>840 ±15 nm</td>
</tr>
<tr>
<td>Output power (at tissue)</td>
<td>20 mW</td>
<td>15 mW</td>
</tr>
<tr>
<td>Irradiation time</td>
<td>15 sec</td>
<td>47 sec</td>
</tr>
<tr>
<td>Irradiation area</td>
<td>0.03 cm²</td>
<td>0.07 cm²</td>
</tr>
<tr>
<td>Power density</td>
<td>0.67 W/cm²</td>
<td>0.214 W/cm²</td>
</tr>
<tr>
<td>Energy density</td>
<td>10 J/cm²</td>
<td>0 J/cm²</td>
</tr>
</tbody>
</table>

REVIEW ARTICLES

J. KUBOTA.
In more recent studies\textsuperscript{(13)} I have used laser speckle flowmetry to give an accurate and real-time assessment of the blood flow and perfusion of flaps during and after irradiation. In the most recent study\textsuperscript{(14)} the flap model used was the axial pattern flap, with a dominant feeding vessel which, in this study, was the iliolumbar artery. Figure 4 shows the experimental plan, with the flap design and the three laser therapy irradiation points. The system I used in this study was a special prototype GaAlAs system designed for me by NIIC Company, Ltd., Japan. I used 100 mW with incident power and en-

Fig 2: Transilluminated laser diode irradiated skin (b) shows profuse neovascularization compared with the control (a).

Fig 3: Flap survival was statistically significantly better for the laser therapy group (b) ($p < 0.05$) compared with the LED (a) and control group (c) flaps.
ergy densities of 18.5 W/cm^2 and 185 J/cm^2, respectively. Figure 5 shows a typical example of a laser speckle flowgraph in an unirradiated control animal, with slightly elevated flow immediately after elevation of the flap (Figure 5a), followed by a gradual decrease of perfusion at 1, 5 and 10 minutes later (Figure 5b,c,d). Figure 6 is a typical speckle flowgraph in an animal from one of the experimental groups. During irradiation, 1 minute after the flap was raised, there was actually a drop in the level of perfusion, but at 5 and 10 minutes later the level and area of perfusion had dramatically increased. Figure 7 shows representative examples of flap survival in the control and three experimental groups, and Figure 8 is the graphic summary of the results, with a statistically significant difference between all the experimental groups and the control (p < 0.01).

Laser therapy and ulcers
In clinical applications, diode laser therapy has been shown to be effective in increasing flow rate in musculocutaneous flaps,(15) is capable of saving vascularly compromised tissue in failing flaps,(16) and successful in enhancing the healing of flaps and promoting healing in indolent severe skin ulcers.(17)

Figure 9 is a 49 y/o female with a severe skin ulcer following infection of a flap. The patient had previously undergone breast reconstruction with a TRAM flap. 7 days after the operation, congestive changes were seen.

![Figure 4: Experimental plan for speckle flowmetry experiment in laser therapy group animals, using an axial pattern flap model. The different points to be irradiated are indicated by group. The control group (A) was unirradiated, but underwent the same procedure as the irradiated groups.](image)

![Figure 5: Composite of typical laser speckle flowgraphs from a control animal. (a): immediately after the flap was raised; (b): one min later; (c): five min after (b); and (d): ten min after (b). Slight increase in blood flow can be seen immediately after elevation of the flap, gradually decreasing over time. A ‘hot spot’ can be seen over the exposed iliolumbar artery at the bottom left in all four images.](image)

![Figure 6: (Below) Composite laser speckle flowgram from a typical experimental group (laser therapy treated) animal. (a): Immediately after raising the flap. (b): During irradiation: slight decrease in overall perfusion is seen. (c): Five minutes later, perfusion is increased with ‘hot spots’ seen in the proximal and mid portions of the flap. (d): Ten min. postirradiation, perfusion is increased.](image)
Fig 7: Flap survival 5 days postop: (a): control Group A; (b): Group B, iliolumbar irradiation; (c): Group C, proximal portion irradiation; and (d): Group D, distal portion irradiation. Groups B, C and D demonstrate much better survival than control Group A. For statistical details, please see Fig 8 below.

![Flap survival graph](image)

Fig 8: Bar graph comparing flap survival at 5 days postop. for all groups, mean value ± standard deviation. Survival in the irradiated groups was statistically significantly better than in control group A (p < 0.01), with no statistically significant difference between Groups B, C and D, although there was a trend B > C > D.

![Flap survival graph](image)

Fig 9: Pretherapy findings and treatment course of a 49 y.o. female with severe infection-related ulcer in a flap. a: Pretherapy findings, after 8 wks of unsuccessful conventional therapy. b: One month of LLLT, improvement seen. c: Final condition after 2 wks of LLLT.
on the tip of the flap. Conventional treatment with ointment was applied, however, the ulcer was complicated by infection and did not improve. Three weeks after the operation, full thickness necrosis leading to infection can be seen on the distal portion of the flap (Figure 9a). Diode laser therapy was started (830 nm GaAlAs diode laser, 60 mW, 15 J/cm²/point C/W). 1 month later, the ulcer had noticeably improved with diode laser therapy (Figure 9b). Finally, eight weeks after the first laser therapy session, the ulcer had healed completely (Figure 9c).

Figure 10 follows a 28 y/o female who developed a severe skin ulcer on the lower leg following a traffic accident resulting in a degloving injury. The degloved wound had been sutured in the accident and emergency department of a nearby hospital. The wound, however, demonstrated congestive changes and ulcerative skin necrosis 20 days after the accident, and it showed no signs of healing (Figure 10a). Diode laser therapy was started (same parameters as above). Ten days after the diode laser therapy, the ulcer had decreased in size (Figure 10b). After 30 days of diode laser therapy, the wound was almost healed (Figure 10c), and further improved at the 80 day point (Figure 10d). Three months after the first laser therapy session, the wound had completely healed (Figure 10e), and scar revision was successfully and easily completed (Figure 10f). This is a good example where laser therapy was used as an adjunctive treatment method in combination with conventional plastic surgery.

Particularly in elderly patients, ulcers may be complicated by or even caused by underlying serious medical conditions. Even in such cases, laser therapy can be extremely successful. A 76-year-old male with essential hypertension and oedematous lower extremities presented with severe suppurative skin ulcers of unknown aetiology on the medial, frontal and lateral aspects of his right knee (Figure 11). The ulcers had failed to respond to conventional ointment and pressure dressing treatment elsewhere for over 5 months, and were extremely

![Fig 10:](image-url)

28 y.o. female with ulcer formation in degloved wound after a traffic accident. a: pretherapy findings 20 days after the accident. b: 10 dy of laser therapy. c: 30 days of LLLT, improvement seen. d: 80 dy of LLLT. e: Three months of LLLT, wound completely epithelialized but with depressive scarring. f: Final condition after successful revision surgery.

![Fig 11:](image-url)

Severe necrotic ulcers unresponsive to conventional treatment for over 5 months on the right knee of a 76-year-old hypertensive male.
Fig 12: One month (left) and three months (right) after the first treatment session, clear improvement seen.

Fig 13: Seven months and 28 sessions later, the ulcers have completely healed with acceptable scarring, and full ROM of the joint.
painful. Normally for ulcers of this severity we would admit the patient and treat on an inpatient basis, but as this patient was nursing his invalid wife, we treated him in the outpatient environment. Defocused diode laser therapy was started (830 nm, 1000 mW C/W, incident irradiance 5 cm from the fibre tip, 669 mW/cm²), once per week as the patient was unwilling to attend twice per week, 10 minutes per session (21 J/cm²). Figure 12 shows the results at 1 and 3 months after the first session, with an obvious improvement in the condition of the ulcers, and complete control of the pain. The pretibial oedema had also improved. The final result after 28 sessions (7 months) can be seen in Figure 13, with complete healing of the ulcers and acceptable scarring. There has been no recurrence in over 3 years.

Failing flaps and grafts

Failing flaps are a major problem for the reconstructive surgeon, but laser therapy has proved very efficient in rescuing vascularly compromised grafts and flaps. A 16-year-old girl had a popliteal tissue defect following a traffic accident (Figure 14), which was to be repaired with a myocutaneous free flap designed on the latissimus dorsi. Four days post-transplantation the distal end of the flap showed a severe ischaemic change, and it was feared that the entire flap would be lost (Figure 15). Laser Therapy was planned with the 830 nm GaAlAs diode laser (60 mW, 9 J/cm²) in the point pressure mode. The three points for irradiation can be seen marked in Figure 15. Four treatment sessions were given, three days apart, and the improvement with each session can be seen in Figure 16, with the dates seen marked at the side of the flap, corresponding with the treatment days. The final result 2 months after the last treatment session can be seen in Figure 17, with full function returned to the joint, and a fully recovered flap.

Laser therapy in sports injuries

In recent years, there has been a great increase in the amount of interest shown in sports activities, both in Japan and overseas, and many facilities have been constructed world-wide which allow people enjoyable participation in all kinds of sports and athletics. As a result of this increase in sporting activity, the number of sports-associated injuries has also increased concomitantly, not only amongst professionals, but also in amateurs. In tandem with this, the number of occasions when we reconstructive surgeons find ourselves dealing with sports-related injuries has also increased. Such injuries include facial soft tissue trauma, maxillofacial trauma including fractures, hand injuries, secondary defects such as ulcers following severe contusions, and so on. In addition, solar ultraviolet damage to skin caused by sun overexposure related to outdoor sports has also shown a recent increase. For all of the above conditions, we are investigating noninvasive and minimally invasive therapies, with the combination of laser therapy with laser surgery and conventional surgical and therapeutic methodology. The following questions are extremely important.
Laser therapy and oedema

Will it be possible to reduce oedema with laser therapy? The literature suggests that this is a good application of laser therapy, with some excellent examples in the treatment of intractable post mastectomy lymphoedema.\(^{18,19}\)

We currently treat oedema which invariably occurs after facial or other injuries with hot pack or cold compress treatments, however usually at a fairly late stage after the injury. If laser therapy could be applied at an earlier stage, such as immediately postinjury, then the earlier reduction of oedema will not only allow the patient an earlier release of swelling-related pain, but it would also allow us to carry out reconstruction of broken bones at an earlier stage.

Laser therapy and bone healing

Will laser therapy speed up the healing of bony fractures? If it is possible, and already the literature strongly suggests it is,\(^{20,21}\) laser therapy intervention in facial bone reconstruction will reduce the necessary inter-maxillary fixation period for treating malocclusion caused by maxillary and mandibular fractures, for example. If a prosthetic implant is required, it has also been shown that laser therapy will speed up good osseointegration in addition to the formation of new, active osteoblasts.\(^{22}\)

All of these positive effects of laser therapy will enable patients to resume normal activities after a much shorter period of time.

Laser therapy and TMJ pain

Will laser therapy treat TMJ pain? One of the most common events in many contact sports is a collision involving a player’s face with a fast-moving object, such as a ball or another player, or a stationary object such as the ground or a goal post. The resulting injury even at its mildest inevitably results in pain, which is considerable in the case of a mandibular fracture. Our experience with laser therapy in TMJ pain is very promising, and we feel it will have good indications in this difficult to treat pain entity. A paper dedicated to the subject used MRI to show the improvement in a typical TMJ disorder following laser therapy using a defocused Nd:YAG dental laser system, with photographic proof of the realignment of the mandibular condyle and the articular eminence of the upper mandible.\(^{23}\)

Following on from that study, I carried out a study of my own in examples of sports-related TMJ pain and found that LLLT was extremely effective in removing both the TMJ pain, and restoring correct range of movement to the lower mandible. Patients were admitted to the trial with TMJ pain with or without any temporomandibular disorder (TMD) such as submaxillary dyskinesia, trismus or TMJ clicking. There were 16 patients, 12 with acute pain (6 male, 6 female) and 4 with chronic pain (3 female, 1 male). Ages ranged from 14 yr to 56 yr (mean age 30.7 ± 12.4 yrs). There were nine patients with right-side TMJ pain, five with left side pain and two with bilateral pain (Table 2). The average number of treatment sessions required for the acute cases was two, with eleven sessions being required on average for the chronic cases. Pain was assessed using the visual analogue scale (VAS) technique. The defocused GaAlAs diode laser was used, 830 mW C/W, 1000 mW, 669 mW/cm\(^2\), 6 – 10 J/cm\(^2\) per point. In only one of the chronic cases was LLLT ineffective, and in all other cases the final VAS was from 2 to zero. No patient reported exacerbation of the pain, and there were no adverse side effects reported either.

Figure 18 illustrates a typical course of treatment and results in a 25 y.o. male who complained of sudden right TMJ pain which had appeared suddenly one month prior to presenting, and he developed trismus. At the first medical examination, the VAS pain score was 5, with a maximal mandibular opening of 10 mm, free lateral movement of the lower mandible, but with pain. After the first LLLT session, the VAS score dropped to 1.5, with a mandibular range of 25 mm. One week later, pretherapy VAS score was 2 and a mandibular opening of 25. After the second session, the VAS was 1 with a mandibular range of 28 mm. Ball games are often associated with TMJ injury, and a 17 y.o. female was...
struck hard on her right maxillary area by the ball during a basketball game. As the TMJ and surrounding area was very painful, she presented on the same day at the accident and emergency outpatient department of our university hospital for a check-up. X-rays revealed no bony damage, so she was simply followed to observe any progression of the pain. Two days after that, her pain was still fairly severe and she had developed trismus. Her first pretherapy VAS score was 7 with a maximal mandibular opening of 15 mm. After the first LLLT session, the VAS score dropped to zero, and her mandibular range increased to 35 mm. One week later, these scores were the same, and she required no further treatment (Figure 19). I was able to conclude that laser therapy was ideal for the treatment of acute TMJ pain where there was no underlying TMD or bony tissue damage.

**Laser Therapy and hypertrophic scarring in skin flaps**

Will laser therapy help with healing flaps as prophylaxis against hypertrophic scarring? In many cases of skin and soft tissue necrosis resulting in tissue deficiencies, primary suturing may not be possible. In these cases, a skin flap or graft has to be applied. We have shown that laser therapy promotes and accelerates the healing of healthy flaps, and very successfully reverses necrosis in vascularly compromised flap and graft tissue, as already illustrated above. We have also had good experience with the use of laser therapy in prophylaxis against hypertrophic scarring, and in the treatment of young and mature hypertrophic scars.

**Laser therapy and ultraviolet skin damage**

Will laser therapy help with the treatment of UV-mediated skin damage? There are two types of UV-mediated skin damage which are associated with overexposure during some form of outdoor sports, including those where strongly reflected UV is an additional component, as from snow. With repeated overexposure pigmented freckles and other areas of abnormal pigmentation may well result. Secondly, due to the increase in solar UV-mediated skin damage due to the thinning of, or appearance of actual holes in the ozone layer, the incidence of skin cancer is expected to rise in the near future. To help with these problems, the combination of laser therapy with laser surgery and conventional methodology is expected to provide the best treatment, coupled with stronger levels of general preventative education. With regard to repairing photoaged skin, however, this is an arena where LED-based systems have very recently come into their own, and a definite application for this new modality for athletes and indeed anyone with photodamaged skin.

**In Short**

Laser therapy has areas in which its effects are already well documented, and these increase with almost every publication on the clinical or experimental application of laser therapy. Increased blood flow, pain attenuation, enhanced wound healing, arthroses treatment and hypertension are amongst the ever-increasing list. In addition to all specific indications, an extremely important basic consideration is that laser therapy has been consist-
tently shown to enhance the body’s own natural compulsion to achieve homeostasis through its own inherent powers of healing, recuperation and balance. The semiconductor laser has been reduced dramatically in size, but has the potential for further even more dramatic miniaturization, and are even now capable of being powered for long periods of time by conventional alkaline batteries. Such small, light lasers can therefore be used anywhere, including the possibility of on-the-spot treatments at the side of the pitch to treat injuries while they are still in their most acute stage, the stage at which laser therapy has been shown to be most effective. These possibilities are slowly being realized as pitch-side therapy is explored. Miniaturization will finally allow us to use implantable lasers powered by tiny batteries to deliver carefully metered doses of laser radiation directly to atrophic muscles and damaged nerves, the laser therapy of the future, but in fact just around the corner. These considerations will not only help injured sports professionals, and amateurs, to recover quickly from their injuries, but may well also increase their potential active span.

The Future

As a theme for the future, I hope that you will investi-
gate the question; “Could laser therapy possibly be applied to improve and enhance physical strength, such as bone structure, muscle strength, respiratory function, autoimmune response, and the promotion of good health?” I hope that some of the presentations you will hear during this meeting will go at least part of the way to answering this exciting and provocative question. Furthermore, the establishment of the concepts of minimally invasive and/or noninvasive surgery and therapy proceeds concomitantly with a great deal of investigative work, so that an injured sports professional will be helped in their return to normal and professional sports activities in as short a time as possible.

One of the most exciting visions of phototherapy in the future is the new generation of LEDs, mounted in arrays so that they can deliver a clinically useful intensity over a large area and in a hands-free manner. The efficacy of near infrared LED therapy at 830 nm for sports-related injuries and pain has already been reported in a previous issue of the journal, used in a specialist sports clinic. I believe that the LED-based system will be one of the bright lights in the phototherapy firmament during the next few years.

Conclusions
In conclusion, my hope is that active application of phototherapy, i.e., laser therapy, LED therapy or a combination of both of them, will enable everybody including sports professionals and amateurs to lead healthy lives, with a higher quality of life, and to enjoy sports throughout their lifespan. Although I have shown excellent results for laser therapy and expressed great future hopes for LED therapy in this article, phototherapy is not a 'magic wand', and we must always remember our basic surgical and professional training.

Most of all, all of us who are working in this exciting and expanding area must maintain open minds to new modalities, or to improved indications of older, tested ones. We must never forget that laser and LED therapy are only two of the modalities we have at our disposal, and always examine every possible method before selecting our treatment on a patient by patient basis. To paraphrase a well-known axiom, phototherapy will not make a bad sports doctor into a good one, but it may well help good sports doctors to become even better and will certainly make their patients happier.

References