IN CONVERSATION WITH

Dr Peter Shumaker

Interviewed by Professor Andrew Burd

Dr Peter Shumaker, Chairman of the Department of Dermatology at the Naval Medical Center in San Diego and Associate Professor of Dermatology at the Uniformed Services University of the Health Sciences will be speaking this year at The International Scar Treatment Conference in Tel Aviv, Israel. In anticipation of the meeting, **Professor Andrew Burd**, Editor of The PMFA Journal and Consultant Burns & Plastic Surgeon, conducted this interview with Dr Shumaker on the topic of scar treatment and management.

Andrew Burd: Peter, I actually met one of your colleagues several years ago in Shanghai. He was talking about the fractional carbon dioxide laser at a meeting sponsored by Lumenis. We had just started a trial in Hong Kong (I was working there at the time) and they were anxious for me to hear from their KOLs! Thank you very much for taking the time to answer the questions below for The PMFA Journal.

Peter Shumaker: Thank you for the opportunity to participate. You may be thinking of my colleague Nathan Uebelhoer. He was also affiliated with the Navy, but he left the service in 2013. We were both on the JAMA Dermatology paper you reference below, for which I was the corresponding author. Of note I served as co-Editor for The Scar Book published in 2017 by Wolters Kluwer. It is a comprehensive textbook including the viewpoints of top experts in at least 10 different disciplines – dermatology, plastic and burn surgery, occupational therapy, etc. The plastic and burn surgeons who contributed include names you may recognise – Peter Rubin, Sydney Coleman, Rei Ogawa, Michael Longaker, Geoffrey Gurtner, Fiona Wood, Ted Tredget, Matt Donelan, Mayer Tenenhaus, Bruce Potenza, Jane Petro, and others.

Andrew Burd: In 2014 you were one of the co-authors of a paper that appeared in JAMA Dermatology 'Laser treatment of traumatic scars with an emphasis on ablative fractional laser resurfacing: consensus report'. How easy was it to write that paper? That is to say did all the authors experience the same benefits and were the benefits clearly tangible? (A bit of background: our own experience of the fractional laser was favourable but it was labour intensive and took a long time to begin to see positive results. The 2014 paper suggested that fractional resurfacing should be far more utilised as a scar management strategy, but this does pose logistic problems.)

Peter Shumaker: The authors of that consensus paper were among the most experienced in the world in applying the relatively nascent technique of ablative fractional laser resurfacing for traumatic scars. The potential seemed quite clear to all of us at that point, but in that early period the absence of high-quality studies compelled us to present our collective thoughts in a consensus format to stimulate interest and further inquiry. In my view our experience was surprisingly consistent and overwhelming positive, and we had the strong sense that ultimately millions of people around the world suffering from disabling and disfiguring scars could potentially benefit. A variety of experts, including myself, will be gathering in Tel Aviv in March this year for the second International Scar Treatment Conference. Perhaps the time has come to update our recommendations.

Andrew Burd: How do you envisage setting up such a service? Would it be driven by the laser physicians? Or should it be driven by burns and trauma surgeons?

Dr Peter Shumaker.

Peter Shumaker: I have more than 20 years of service in the United States Navy. Military medicine is inherently collaborative, and the Naval Medical Center San Diego contains one of three military centres of excellence in rehabilitation in the US that were established at the peak of the war effort around 2008. It is clear in my experience that patients benefit from co-ordinated multidisciplinary care – surgery, physical and occupational therapy, adjunctive laser treatment, and other interventions should all be viewed as part of a comprehensive rehabilitative effort. From this viewpoint it would be counterproductive to limit the procedure to any single group. Remember that these are not special 'scar' devices.

Fractional laser technology is relatively common and widely distributed, but is used much more commonly for cosmetic applications at the present time. Many physicians are already endowed with the knowledge and tools to begin this type of treatment. The current barriers to upscaling traumatic scar treatment with fractional lasers have more to do with reimbursement issues and inertia.

It should not be surprising that dermatologic surgeons were the first to employ the technique for traumatic scars. Laser surgery is a core part of procedural training in dermatology, and we are very familiar with cutaneous laser tissue interactions. Rox Anderson is a dermatologist and was also an author on the consensus paper. It was his group at Wellman Labs that invented fractional lasers (and many other common platforms). As mentioned earlier fractional lasers were not designed specifically for scars; they were repurposed based on the somewhat serendipitous observations of some astute early adopters. It is counterintuitive that re-burning a scar would lead to significant, reproducible, and permanent improvements in the scar tissue with an excellent safety profile. Nonetheless this specific pattern of injury does just that. Many of the larger prospective studies involving burn scars are now coming out of burn centres, and I certainly expect this trend to continue and accelerate. There is also a huge range in traumatic scarring, from a simple laceration or dog bite to a large surface area burn.

In short, the application belongs to both dermatologic surgeons and burn and trauma surgeons.

Andrew Burd: From a burns perspective our strategy is always to try and prevent or limit scars. Indeed our acute care was so good in my unit in the UK that we did very little reconstructive work and contractures and disability were limited. How do you feel about providing a solution for a problem that might better be prevented from occurring in the first place? (Of note my research thesis was titled 'Towards Scarless Healing' – I did the work whilst a research fellow at Harvard when I was collaborating with investigators looking at the phenomenal healing of the foetus.)

Peter Shumaker: These goals are not mutually exclusive. Unfortunately many burn patients worldwide are not in a position to receive prompt, high quality surgical care after injury and diligent aftercare following discharge. Furthermore, what of the millions of patients worldwide with existing traumatic scars? I would also argue that the 'limited' contractures you describe are ideal candidates for a minimally invasive procedure such as fractional laser resurfacing. We are still largely unfamiliar with the cellular and molecular mechanisms that lead to scar improvement after fractional laser treatment. It might be that a breakthrough in scarless wound healing arises from study of these pathways. Laser-assisted delivery of novel agents through the fractional channels could also go hand-in-hand with new discoveries.

Ablative fractional laser treatment has been a part of the standard of care in our institution for traumatic scars for nearly a decade, and in scattered centres in the US and around the world. In my opinion institutions that do not have the technology available as an adjunctive treatment for traumatic scars are not offering the best available care to their patients. It is not yet the worldwide standard of care since the supporting literature is still relatively immature, but I am confident that it will continue to expand.

Andrew Burd: Do you see a biological variation in response to the fractional laser?

Peter Shumaker: That is a broad question, but I certainly do expect there will be variations in response elaborated over time. Generally speaking in my experience, scars of virtually any origin and age can potentially benefit from fractional laser treatment. Studies elucidating the optimal treatment settings, combinations, order, and patient populations are still largely lacking.

I should point out that when we speak of fractional lasers there are two varieties – ablative and non-ablative. I use both very commonly, but there will be differences in the treatment response. For example in my practice I generally use ablative fractional lasers first when there is a range of motion and wound healing issues, and non-ablative when the problems are limited to relatively minor textural or pigmentation issues. Many patients receive both.

Andrew Burd: Can you confidently predict what improvement can be expected from the laser treatment of scars in each patient? If not at what stage does a prediction become more realistic? (After two, three, six treatments, etc.)

Peter Shumaker: In my experience, if judicious treatment settings are applied virtually 100% of patients will experience at least some improvement in the quality of their scar tissue beginning within a few weeks of each treatment. It can range from modest improvements in pliability or texture to fairly dramatic improvements in range of motion, wound healing, pain, and itch. The final result varies significantly with the underlying injuries, and according to individual variations in response and treatment technique that we do not fully appreciate at this time. I usually see the biggest functional gains in the first three to five treatments, but textural irregularities and dyspigmentation can continue to improve with additional treatments.

Andrew Burd: Is the laser treatment given as part of a package of care or is it independent of other factors? i.e. can the same results be anticipated by different operators working in different countries, institutions, etc.? I would personally suspect that this is not the case and that there is an art as well as a science to laser treatment of scars. What are your personal thoughts?

Peter Shumaker: There are two parts to your question. I totally agree that effective scar management integrates both art and science. The fractional laser is a powerful tool, but must be applied with well-considered settings, timing, combinations, all in view of the specific characteristics of the patient. The physical act of applying the laser energy to the skin with the pattern generator is not technically very difficult, and in that sense should be widely reproducible.

There are many fractional laser platforms, and simply ablating tissue with light of a wavelength of 10,600 or 2940nm is not sufficient to guarantee good results. As you well know scar tissue is underprivileged with regard to normal skin, and it is certainly possible to make scarring worse with poorly applied treatment. Carbon dioxide lasers have been around for decades, but the advance in technology that has led to us have this conversation emerged around 2004 with non-ablative fractional platforms, and in 2007 with ablative fractional platforms.

An array of relatively widely spaced, narrow ablative columns at depths unavailable to previous technology appears key to the beneficial tissue effects. Fractional lasers were the first to allow operators to select the density and the depth of treatment, and offer unprecedented levels of control. While the optimal parameters have yet to be determined, a narrow micro-column diameter with limited surrounding tissue coagulation, a short pulse width,

and low treatment densities appear to be important considerations for safe, effective treatment of traumatic scars. So, it is a combination of the training and the tools.

Laser treatment is absolutely part of a 'package of care'. It is rare that a patient of mine with significant functional limitations will not also be engaged in concurrent physical or occupational therapy and have ongoing surgical consultation. Fractional laser treatment should be considered as an important adjunctive treatment to optimise the results of surgical management, and not a replacement or entirely independent entity. I frequently receive referrals from our surgeons, and I do not hesitate to enlist their assistance for surgical revision when the situation calls for it. I have been leading a multidisciplinary burn scar management exchange in Vietnam since 2013. Patients with extensive scarring and severe contractures often receive both surgical and laser scar revision in the same session.

Tissue rearrangement, etc. can relieve the prominent contractures, but the results will simply not be as good as if the quality of the surrounding scar tissue is also improved with laser intervention. In less severe cases, the laser alone can be an effective treatment, though 'alone' may also mean in combination with other standard treatments such as corticosteroids, silicone, etc.

Andrew Burd: I can recall many years ago, Thomas Mustoe and some of his wound healing friends speaking about having a consensus on silicone gel (Mustoe TA, Cooter RD, Gold MH, et al. International clinical recommendations on scar management. Plastic and Reconstructive Surgery 2002;110(2):560-71.) It seemed fashionable, if not a little pretentious. I am now hearing some very interesting preliminary results from using botulinum toxin in hypertrophic scars. Setting up a wide reaching service to treat scars with the fractional laser does have significant resource implications. Have you modelled the financial implications with the cost benefits? And what time scale is being factored in to generate a return of investment? Are you confident that there will be no other competing management strategies that might be much simpler and cheaper e.g. botulinum toxin?

Peter Shumaker: As a military physician I have had the luxury of not having to consider insurance reimbursement in my treatment decisions. As I mention below, on a systemic level the cost considerations must also include aspects such as the potential for enhanced and more rapid rehabilitation, decreased pain and disability, and perhaps an earlier return to school and work. These are not easy calculations to make, but my sense is that collectively costs could decrease significantly. We have a technology that is relatively safe, effective, and widespread right now. Research should continue, but it makes little sense to hold off in the hope that something else might materialise. On the individual practice level, in the United States two new CPT (procedural billing) codes have been established for the fractional ablative laser fenestration of burn and traumatic scars for functional improvement. The greater potential for reimbursement will undoubtedly accelerate the adoption of the technique in the US.

You specifically mentioned botulinum toxin. I don't see these as competing modalities, but rather as additional tools in the kit. The literature suggests interesting effects of botulinum toxin on early scars, such as inhibiting fibroblast differentiation.

However, there are more equivocal effects on existing scars. These leads are well worth exploring. Either way the applications are going to be more restricted in areas of involvement. When you consider the scale of large traumatic scars such as burns, and in particular large mature burn scars, you realise these modalities occupy different niches in scar management.

Andrew Burd: Would it perhaps be better to put more effort into preventing pathological scars from developing in the first place rather than setting up an extensive infrastructure to treat scars?

Peter Shumaker: The search for advancements in scar mitigation, and even the 'holy grail' of scarless wound healing should absolutely continue. I feel strongly that more widespread adoption of these techniques now will only accelerate the process of discovery, and in the meantime the lives of countless patients with disfiguring and debilitating scars could be improved. The infrastructure is largely already there, as these devices are already present in a wide variety of practices. It is true that lasers are relatively expensive to purchase and service. However, it would be helpful to think of costs as a whole rather than in isolation. There are devices available that require minimal ongoing consumables, and each could be leveraged to treat thousands of patients. If you consider that patients may ultimately require less medication, less therapy, less time off of work, less care from family members, etc., the overall costs to the system may actually decrease significantly. As I mentioned before, in my opinion all burn centres should have access to this technology. Patients simply aren't getting the best available care, even if it is not yet recognised as the current international standard of care. I have little doubt that it will become more widespread in the coming years.

Andrew Burd: Is fractional laser purely ablative or are there definable biological responses and cellular and molecular level within the treated scar?

Peter Shumaker: This particular pattern of thermal injury has been shown to induce a robust cellular and molecular response with resulting changes in collagen architecture and composition, though the details have yet to be fully realised. Characterising and then targeting these pathways with specific agents and interventions will make up a significant portion of future research. My impression based on experience and prior literature is that there is a 'Goldilocks' thermal component that drives the remodelling response – too little and the results may be suboptimal, too much and worsening scarring may result. However, the efficacy of skin needling indicates that the fractional pattern itself does have some positive effects.

Andrew Burd: What work is being done to look at combining laser therapy with such things as PRP and stem cells?

Peter Shumaker: Ultimately laser-assisted delivery of various agents may be recognised as one of the greatest contributions of fractional technology. Large molecules and even cells can be delivered beyond the epidermal barrier to their targets in the skin and elsewhere. Parameters such as microcolumn density, depth, and diameter can be adjusted to optimise delivery, and voluminous research is ongoing with the agents you mentioned, and many others. Currently the fractional laser management of hypertrophic scars is frequently complemented with assisted delivery of drugs such as triamcinolone and 5-fluorouracil. No doubt other agents will be added in the future. In my experience ablative fractional laser pre-treatment is also helpful prior to contour restoration (i.e. fat grafting) and follicular grafting into scar tissue.

Andrew Burd: When writing a CME paper on scarring back in 2005 we were looking at normal, hypertrophic and keloid scars as clinical phenomenon that did not have a biological continuum. We recognised a wide variety of responses to different treatments at that time and suggested that this was due to the molecular characterisation of the scar tissue. Back

then we were predicting that keloid scar management would one day become more like lymphoma management where the treatment is determined on an individual patient basis. What do you think about this view?

Peter Shumaker: Keloids are still a very frustrating entity to treat, and much remains to be learned. As you are well aware they behave very differently from hypertrophic scars, but unfortunately they are combined in many of the existing studies and at times are not easy to differentiate. I would much rather treat a hypertrophic scar because the prognosis is significantly better. Fractional lasers have offered some additional therapeutic options, especially when combined with agents such as corticosteroids and 5-fluorouracil. What is interesting to me is the seemingly low propensity to induce or worsen keloids. While this outcome must still be considered, fractional lasers are often used to treat keloids and I am not hearing about many complications among my colleagues or in the literature. No doubt as we learn more about the pathophysiology of keloids we will be able to tailor treatment more effectively.

FURTHER INFORMATION

Scars II – The 2nd International Scar Treatment Conference
21-22 March 2018
Tel Aviv, Israel

For more information or to register for the meeting, visit:
http://scars2018.herokuapp.com

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