

CO₂ laser for scar improvement: so what's new?



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Nearly every person will have a scar in their lifetime - 100 million new scars occur each year in the developed world alone. A scar is always the result of some form of injury and can be a painful reminder of trauma suffered.

Improving scars is challenging. Most people know that there is no way to 'erase' a scar and may seek advice from a plastic surgeon to try to revise them. Occasionally, there will be valid reasons why scars are less than optimal, such as delayed healing, wound infection or dehiscence. If so, the answer could be as simple as cutting out the scar and starting again.

Key messages

- CO₂ laser is a game-changer in the treatment of problematic scarring
 - Many types of scarring can benefit from CO₂ laser; especially tight, raised and itchy scars
 - Improving scarring can require a multi-modal approach, combining laser with surgery.
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But what if the wound healing was uncomplicated and the closure technique was adequate? What if the scars are too large to excise or the patient has keloids?

The risks of intervening in such situations are fraught with risk and many clinicians are rightly loath to make a bad situation worse. Patients are often disappointed with this response, even if it is based on sound reasoning, it doesn't help their problematic scar.

CO₂ laser has been used for many decades treating various cutaneous conditions such as ablating skin lesions and resurfacing wrinkles and rhinophyma. However, its use in treatment of scarring was limited as the continuous laser beam delivery method meant the entire surface area treated was ablated, and the open wound had to heal from deeper structures.

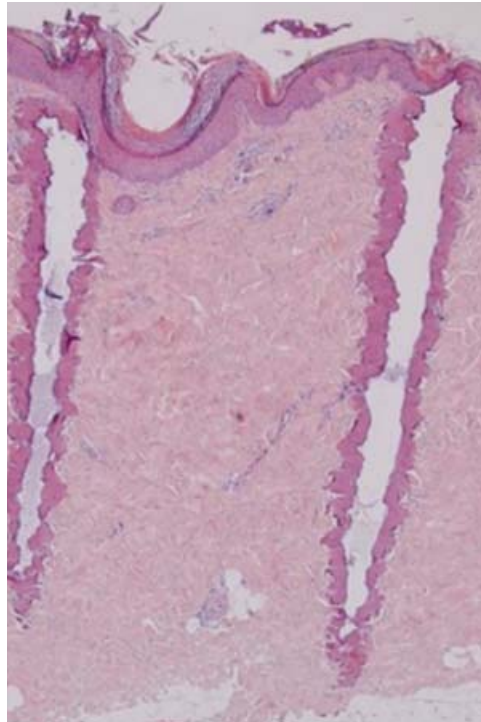
This was very risky in scars, as the deeper dermal appendages from which skin re-epithelialises are far fewer, increasing chances of delayed healing, infection, pigmentation change and worse scarring.

All of this changed with the invention of fractional CO₂ laser delivery in the mid-2000s, whereby laser beam energy is delivered in tiny columns called micro-thermal zones (MTZs) to the scar, leaving undamaged adjacent epithelium (see image). This allows rapid re-epithelialisation of the treated areas within days, while still allowing the laser energy to penetrate and stimulate remodelling of scar collagen.

Plastic surgeons specialising in burns were early adopters of this new fractionally delivered CO₂ laser treatment, as patients with extensive hypertrophic scars have few reconstructive options.

Large series data and several RCTs have shown that CO₂ laser can improve scarring clinically in terms of appearance and function and at a histological level can alter RNA and change dermal architecture towards that of normal skin. Most clinicians now agree that hypertrophic burn scars are improved by CO₂ laser treatment. But what about other types of scarring?

Post-surgical hypertrophic – most surgical scars look reasonable up to six weeks post-operatively and then proliferate in vascularity and thickness until six months. After this, scars remodel for 12-18 months and hopefully leave a flat



Histological section showing MTZs deep into the skin with intact epithelium adjacent to each zone (image courtesy of Lumenis)


pale line. For surgical or traumatic scars which persist in hypertrophy or are itchy and/or sore during remodelling, CO₂ laser can help flatten and relieve symptoms.

Keloid scars – in our experience CO₂ laser provides excellent relief of itch and pain in most keloids and will improve scar thickness in around 50% of cases. Relief of symptoms is often temporary, however, and many patients request repeat treatment every three to six months. In very large keloids, or those which are impacting on

function, surgical excision followed by repeated sessions of CO₂ laser can slow the return of the keloid growth. This requires careful risk counselling with the patient, as keloids can always worsen with surgery.

Tight scars – scars over functional and mobile areas of the body (e.g. hands, feet, joints) may look flat but feel tight and restrictive to the patient. When the scar is too extensive to remove or realign with local flaps or z-plasties, CO₂ laser is a good option to loosen scars.

This probably works as a combination of micro-perforations of the scar with MTZs followed by remodelling (many patients feel increased scar pliability immediately post-laser). A combination of laser and surgical revision can effectively treat restrictive and raised scarring, releasing tension and stimulating collagen to remodel simultaneously.

In summary, the treatment of scarring has progressed over the past 15 years and CO₂ laser is now firmly inside the modern toolbox for scar treatment. 

ED: Dr Douglas, Dr Rea and Dr Goodwin-Walters are all specialist plastic and burns surgeons.

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