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# Increased Collagen VII Expression with Fractional Ablative Laser Therapy in RDEB

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## Abstract

**Background:** Recessive dystrophic epidermolysis bullosa (RDEB) is a genetic skin disorder resulting in severe skin fragility, frequent blisters, scarring, increased risk of squamous cell carcinomas, and decreased life expectancy. RDEB results from autosomal recessive mutations in type VII collagen, which is a critical component of the basement membrane. Skin fragility can predispose patients to great morbidity, and effective methods to prevent and treat these lesions are limited.

**Study Design / Methods:** We report the case of a 27-year-old woman with a mosaic phenotype of RDEB who presented for management of large non-healing chronic erosions on her upper back and posterior neck. These areas were treated with deep fractional carbon dioxide (CO<sub>2</sub>) laser, which has been shown to help with collagen remodeling in other clinical scenarios. Immediately after treatment, topical poly-L-lactic acid (PLLA) was placed on the skin surface to act synergistically with the laser. Additionally, punch biopsies were performed to compare the collagen distribution in treated and untreated skin.

**Results:** After seven treatments, patient exhibited significant clinical improvement with decreased bleeding during the procedure and decreased frequency of blistering. On hematoxylin and eosin staining, the untreated skin featured abnormal collagen organization whereas the treated skin demonstrated a collagen distribution akin to normal skin. Furthermore, a Herovici stain was performed to differentiate mature (type I) versus immature (type III) collagen, with a notable shift in expression patterns between the treated and untreated samples. Samples were also evaluated for direct immunofluorescence for type VII collagen, which confirmed that the treated samples had increased type VII collagen compared to the untreated sample.

**Conclusions:** This case illustrates the potential for fractional CO<sub>2</sub> laser in combination with PLLA to aid in the normalization of collagen and the potential for a “mechanical” treatment to increase activity of collagen VII in select patients with RDEB.

## Background

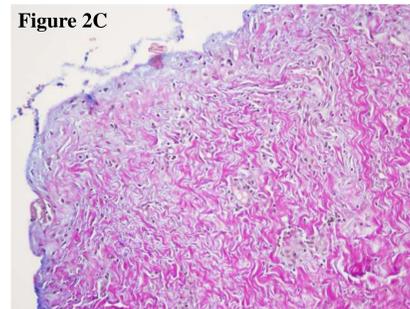
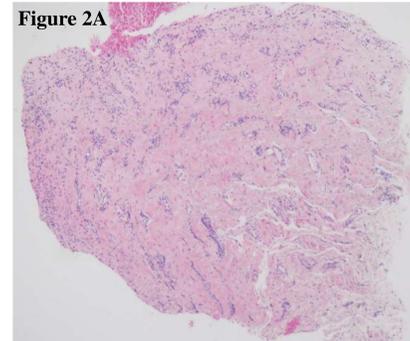
- Recessive dystrophic epidermolysis bullosa (RDEB) is a genetic skin disorder resulting in severe skin fragility, frequent blisters, scarring, increased risk of squamous cell carcinomas and decreased life expectancy. RDEB results from autosomal recessive mutations in type VII collagen, which is a critical component of the basement membrane. Skin shearing can predispose patients to great morbidity, and effective methods to prevent and treat these lesions are limited.
- Published case reports indicate that fractional laser therapy in patients with scars aids in collagen remodeling and overall cosmesis. Fractional ablative laser therapy also demonstrated accelerated wound healing in similar patients with RDEB. Furthermore, the topical application of poly-L-lactic acid (PLLA) following fractional ablative laser treatments likely has a synergistic role in both collagen remodeling and cosmesis. We hypothesized that fractional ablative laser and topical PLLA treatments may enhanced wound healing in patients with genetic alterations in collagen, improve skin integrity, and loosen contracted skin.

## Study Design / Methods

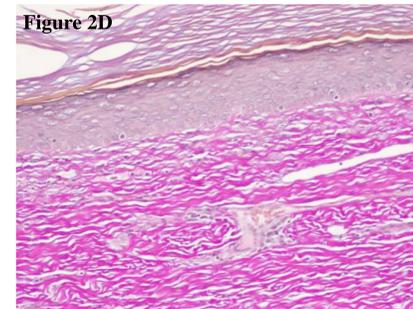
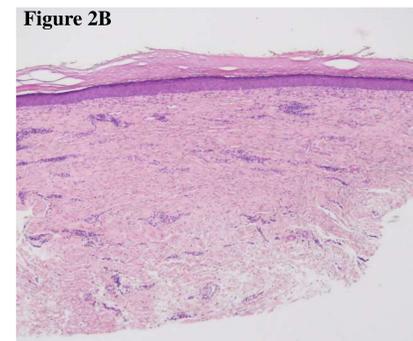
- We report the case of a 27-year-old woman with RDEB with revertant mosaicism who presented for management of large non-healing chronic erosions on her upper back and posterior neck complicated by frequent staphylococcal infections. She had been using topical wound care under the care of Dermatology without significant improvement. Physical examination revealed a 15 x 12 cm erythematous crusted plaque on the posterior neck (Figure 1A). Fractional carbon dioxide (CO<sub>2</sub>) laser treatments with a single pulse / non-overlapping technique with settings of 15 mJ of energy and 15% density were sequentially administered (15 treatments over two years). Immediately after each treatment, concentrated topical PLLA was applied to the treated area. Punch biopsy specimens were obtained from treated and untreated affected skin after the seventh treatment for histopathologic examination.

## Histopathology

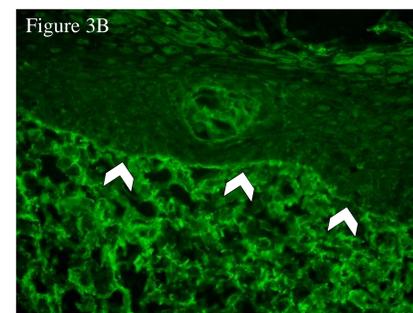
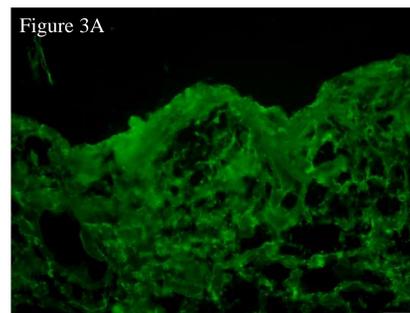
### Untreated Skin



### Treated Skin



On examination with hematoxylin and eosin staining, the untreated skin specimen demonstrated a detached epidermis with dermal fibrosis and chronic inflammation, and the treated skin specimen showed scarring, fibrosis and chronic dermal inflammation, with an intact epidermis (Figures 2A and 2B, respectively). Additionally, in the treated specimen, the epidermis demonstrates compact hyperkeratosis (2B). Notably, with respect to the collagen organization, the specimen from untreated skin demonstrated thick, jumbled collagen (Figure 2A), whereas the specimen from treated skin had finer collagen with more definite “east-west” organization (Figure 2B). On examination with Herovici staining that differentiates mature type I (pink) and immature type III (blue) collagen, treated skin demonstrated an increase in type I collagen (Figures 2C and 2D).



Indirect immunofluorescence studies to detect collagen VII were additionally performed on biopsy specimens from the patient’s untreated affected skin and treated affected skin using serum with known IgG collagen VII antibodies using fluorescein isothiocyanate-conjugated antibody to human IgG as the secondary/detection antibody. The treated affected skin (Figure 3B) shows that collagen VII is detected along the basement membrane zone (BMZ, white arrowheads) whereas the untreated affected skin does not.

## Clinical Photography

Figure 1A



Figure 1B



## Results

- Fractional ablative laser treatments in this patient have resulted in considerable clinical improvement including thickening of the dermis, which resulted in decreased intraoperative bleeding (Figure 1B). Since the time of treatment, the patient has reported marked improvement with a decreased number of erosions as well as decreased pain. On hematoxylin and eosin staining, the untreated skin had abnormal collagen organization whereas the treated skin demonstrated a more organized scar-like pattern. Furthermore, a Herovici stain was performed to differentiate mature (type I) versus immature (type III) collagen; increased collagen type I was noted in the treated specimen. Specimens also were evaluated by indirect immunofluorescence for type VII collagen, which demonstrated that type VII collagen was detected in the specimen from treated affected skin compared to the untreated sites.

## Conclusions

- This case illustrates the potential for a “mechanical” treatment, fractional CO<sub>2</sub> laser with topical PLLA, in certain patients with RDEB as an adjunctive measure in their care. It is unclear whether the benefit is a result of scarification of the treated area versus the normalization of collagen (i.e., apparent induction of collagen VII expression).

## References

- Lee SJ, Suh DH, Lee JM, Song KY, Ryu HJ. Dermal Remodeling of Burn Scar by Fractional CO<sub>2</sub> Laser. *Aesthetic Plast Surg.* 2016;40(5):761-768.
- Ibrahim SM, Elsaie ML, Kamel MI, Mohammed EE. Successful treatment of traumatic scars with combined nonablative fractional laser and pinpoint technique of standard CO<sub>2</sub> laser. *Dermatol Ther.* 2016;29(1):52-57.
- Ozog DM, Liu A, Chaffins ML, et al. Evaluation of clinical results, histological architecture, and collagen expression following treatment of mature burn scars with a fractional carbon dioxide laser. *JAMA Dermatol.* 2013;149(1):50-57.
- Tierney E, Mahmoud BH, Srivastava D, Ozog D, Kouba DJ. Treatment of surgical scars with nonablative fractional laser versus pulsed dye laser: a randomized controlled trial. *Dermatol Surg.* 2009;35(8):1172-1180.
- Rkein A, Ozog D, Waibel JS. Treatment of atrophic scars with fractionated CO<sub>2</sub> laser facilitating delivery of topically applied poly-L-lactic acid. *Dermatol Surg.* 2014;40(6):624-631.
- Hasegawa T, Ikeda S. Surgical management with CO<sub>2</sub> laser for pseudosyndactyly in recessive dystrophic epidermolysis bullosa. *J Dermatol.* 2014;41(8):767-768.
- Krakowski AC, Ghasri P. Case report: rapidly healing epidermolysis bullosa wound after ablative fractional resurfacing. *Pediatrics.* 2015;135(1):e207-210.
- Minicucci EM, Barraviera SR, Miot H, Almeida-Lopes L. Low-level laser therapy for the treatment of epidermolysis bullosa: a case report. *J Cosmet Laser Ther.* 2010;12(4):203-205.
- Yang J, Wang S, Dong L, et al. Skin healing and collagen changes of rats after fractional erbium:yttrium aluminum garnet laser: observation by reflectance confocal microscopy with confirmed histological evidence. *Lasers Med Sci.* 2016;31(6):1251-1260.