

## Randomized controlled study for the anti-aging effect of human adipocyte-derived mesenchymal stem cell media combined with niacinamide after laser therapy

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## A Case of Congenital Melanocytic Nevus Clinically Improved by Fractional Carbon Dioxide Laser Treatment

*Yang, Y.J., Choi, Y., Nam, J., Kim, H.J., Lee, G., & Kim, W. (2010). A Case of Congenital Melanocytic Nevus Clinically Improved by Fractional Carbon Dioxide Laser Treatment. Korean Journal of Clinical Dermatology. 2010;48(6):510-512.*

No laser parameters discussed.

A total of 18 treatments were performed to achieve clinically significant improvement

## A Case of Squamous Cell Carcinoma Treated with Photodynamic Therapy with Ablative Carbon Dioxide Fractional Laser

*Kwon SH, Yang JY, Kim YC. A Case of Squamous Cell Carcinoma Treated with Photodynamic Therapy with Ablative Carbon Dioxide Fractional Laser. Annals of dermatology. 2019;31:S46-S48. doi:10.5021/ad.2019.31.S.S46*

Subject was treated with ablative CO2 fractional laser followed immediately by MAL-PDT laser three times in 3 or 7 week intervals.

Laser settings were set to a 1,000um beam size, 30W peak power, 60mJ pulse energy with a density of 100%.

No residual tumor was noted in 2 month post treatment biopsies.

No recurrence was seen at an additional 2 years post treatment follow up.

## A Comparison Of The Scar Prevention Effect Between Carbon Dioxide Fractional Laser And Pulsed Dye Laser In Surgical Scars

*Kim DH, Ryu HJ, Choi JE, Ahn HH, Kye YC, Seo SH. A Comparison Of The Scar Prevention Effect Between Carbon Dioxide Fractional Laser And Pulsed Dye Laser In Surgical Scars. The Journal of Dermatologic Surgery and Oncology. 2014;40(9):973-978. doi:10.1097/01.DSS.0000452623.24760.9c*

Laser was applied to a split scar 3 times over a two week period with a 2 month post treatment follow up.

Parameters for the laser were set to a pulse energy of 80mJ, a density of 100 spots/cm2, with 2 passes in the static mode.

eCO2 was more effective than PDL in the improvement of pliability and thickness of the treated scars.

Scar severity scores via the VSS improved by an average of 46%.

## Ablative Fractional CO2 Laser may be a Novel Treatment for Tattoo Allergic Reaction

*Somayeh H, Zahra A, Behrooz B. Ablative Fractional CO2 Laser may be a Novel Treatment for Tattoo Allergic Reaction. Journal of lasers in medical sciences. 2012;3(3):132-134.*

Seven treatments were performed every three weeks with a power of 100W.

At each treatment visit the allergic reaction showed significant improvement in regards to swelling, redness, and density of pigment.  
Three months post treatment showed clinical remission of the allergic reaction in resulting in high patient satisfaction

### **Ablative fractional laser treatment for hypertrophic scars: comparison between Er:YAG and CO2 fractional lasers**

Choi JE, Oh GN, Kim JY, Seo SH, Ahn HH, Kye YC. Ablative fractional laser treatment for hypertrophic scars: comparison between Er:YAG and CO2 fractional lasers. *Journal of Dermatological Treatment*. 2013;(4):299-303. doi:10.3109/09546634.2013.782090

Patients were treated up to 9 times in 1 to 2 month intervals.

Laser parameters were set to a microbeam energy of 40-60mJ, a density of 150 spots/cm<sup>2</sup>, and 3-5 passes in static mode.

eCO2 average scar score improvement was 49.8% which was significantly higher than the 28.2% for the Er:YAG device.

Both physician and subject objective scoring indicated that eCO2 outperformed the Er:YAG device, with both measures being nearly a full point on average higher for eCO2.

### **Ablative Fractional Laser-assisted Daylight Photodynamic Therapy for Actinic Keratoses of the Scalp and Forehead in Organ Transplant Recipients: A Pilot Study**

Rizvi S, Veierød M, Mørk G, Helsing P, Gjersvik P. Ablative Fractional Laser-assisted Daylight Photodynamic Therapy for Actinic Keratoses of the Scalp and Forehead in Organ Transplant Recipients: A Pilot Study. *Acta dermato-venereologica*. 2019;99(11):1047-1048. doi:10.2340/00015555-3274

Patients were treated a single time with a 30W power with initial pass on their AK lesions and then a full area treatment.

Patients then had a Methylaminolaevulinate cream applied and were then exposed to sunlight for 2 hours.

Treatment with the laser combined with daylight PDT resulted in significantly higher improvement in AK3 lesions, with a response rate of 84.6% versus 18.8% respectively.

### **Ablative Fractionated CO2 Laser Resurfacing for the Face and Neck**

Reddy UP, Woodward JA. Ablative Fractionated CO2 Laser Resurfacing for the Face and Neck. *American journal of cosmetic surgery*. 2011;28(4):273-275. doi:10.1177/074880681102800411

Patients were either treated with a 120 or 300u spot size, with lowered settings for the neck treatments compared to face.

For the 120u spot size, laser settings ranged from 70-90mJ, 75-200 spots/cm<sup>2</sup> and 5.5-15.6% surface area.

For the 300u spot size, laser settings ranged from 55-80mJ, 100-200 spots/cm<sup>2</sup> and 24.5-37.8% surface area.

89% of patients were satisfied with their results following treatment.

Patients stated an appreciation of the blended effect of their face and neck results.

### **Combination Treatment By 10,600nm Ablative Fractional Carbon Dioxide Laser And Narrowband Ultraviolet B In Refractory Nonsegmental Vitiligo: A Prospective, Randomized Half-Body Comparative Study**

*Shin J, Lee JS, Hann S, Oh SH. Combination Treatment By 10,600nm Ablative Fractional Carbon Dioxide Laser And Narrowband Ultraviolet B In Refractory Nonsegmental Vitiligo: A Prospective, Randomized Half-Body Comparative Study. British Journal of Dermatology. 2012;166(3):658-661. doi:10.1111/j.1365-2133.2011.10723.x*

Two sessions two months apart of eCO2 treatment were performed on half of the body with a 5 day interval before NB-UVB therapy was completed.

Laser parameters were set to a pulse energy of 100mJ, a spot density of 150spots/cm2, static mode and 2 passes delivered with the 300-density tip.

Improvement scores were significantly higher in the combination group, with average improvement of nearly a full point by physician and subject grading.

No patients reported significant adverse events, and the expected post-treatment pain, erythema, and edema all subsided within a day.

### **Comparison Of Four Different Lasers For Acne Scars: Resurfacing And Fractional Lasers**

*You HJ, Kim DW, Yoon ES, Park SH. Comparison of four different lasers for acne scars: Resurfacing and fractional lasers. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2016;69(4):e87-e95. doi:10.1016/j.bjps.2015.12.012*

Patients received 3-5 sessions performed every two months with the eCO2 device.

Laser parameters were set to a pulse energy of 50mJ, a power of 30W, and a density of 150spots/cm2

eCO2 had an average improvement score of 5.2/10 following treatment.

Downtime and adverse events were significantly lower with the eCO2 compared to resurfacing lasers

### **Comparison Of Non-Ablative And Ablative Fractional Laser Treatments In A Postoperative Scar Study**

*Shin JU, Gantsetseg D, Jung JY, Jung I, Shin S, Lee JH. Comparison of non-ablative and ablative fractional laser treatments in a postoperative scar study. Lasers in Surgery and Medicine. 2014;46(10):741-749. doi:10.1002/lsm.22297*

Half of a scar was treated with the eCO2 device two times with a two month treatment interval.

Settings for eCO2 device included a pulse energy, which was 60mJ/pulse, a spot density of 100spots/cm2 used in static mode.

eCO2 slightly outperformed the non-ablative laser with an average clinical improvement score of 2.45.

Skin hardness was significantly reduced by the device following treatment.

### **Daylight Photodynamic Therapy with Ablative Carbon Dioxide Fractional Laser for Treating Actinic Keratosis in Asians: A Case Series**

*Yoon, Kim. Daylight photodynamic therapy with ablative carbon dioxide fractional laser for treating actinic keratosis in Asians: A case series. Photodiagnosis and Photodynamic Therapy. 2020;31. doi:10.1016/j.pdpdt.2020.101905*

Patients received 1-3 treatments with the device.

Laser treatment was performed with a 1,000um beam size, a 30W peak power, a 60mJ pulse energy.

An average of two treatments with eCO2 was able to clear the actinic keratosis lesions.

No patients reported treatment pain and there was no recurrence seen up to 12.5 months following treatment.

## Decreased Tissue and Serum Expression of Galectin-7 in Patients with Hypertrophic Scars

Cho SB, Kim J-S, Zheng Z, et al. Decreased Tissue and Serum Expression of Galectin-7 in Patients with Hypertrophic Scars. *Acta dermato-venereologica*. 2013;93(6):669-673. doi:10.2340/00015555-1583

Laser pulses were applied with a pulse energy of 50mJ, a density of 200 spots/cm<sup>2</sup> with a single pass and static operating mode.

The laser treated tissue demonstrated marked galectin-7 expression in the upper papillary dermis on days 1,3, and 10 which may be a crucial link to hypertrophic scars.

## Depth of eCO2 Fractional Resurfacing with 3 Different Spot Sizes on Facial Skin In Vivo

Husain A, Reddy UP, Cummings T, Richard MJ, Woodward JA. Depth of eCO2 Fractional Resurfacing with 3 Different Spot Sizes on Facial Skin in vivo. *American journal of cosmetic surgery*. 2011;28(2):71-74. doi:10.1177/074880681102800203

The 120um tip was used with fluences ranging from 80-160mJ, the 300um tip was used with fluences ranging from 100-180mJ, and the 1,000um tip was used with fluences of 60, 100, 140, 180, and 220mJ.

The 120um tip was able to penetrate 900um into the facial skin at an energy of 160mJ but minimized the surface area that was ablated.

The 1,000um tip was capable of fully ablating the epidermis.

The 300um tip was the middle ground between the other tips in terms of ablation and depth of penetration.

## Early Combination Treatments Of Pulsed Dye Laser, Non-Ablative Fractional Laser And Co2 Laser For Postoperative Scars

Yoon JH, Jeon HB. Early Combination Treatments Of Pulsed Dye Laser, Non-Ablative Fractional Laser And Co2 Laser For Postoperative Scars. *Medical lasers*. 2022;11(2):115-119. doi:10.25289/ML.2022.11.2.115

A PDL device was used one day post surgical revision, and then four weeks later a combination of 595nm PDL, 1,550 Er:Glass and then eCO2 were utilized three times in monthly intervals.

eCO2 parameters were set to 100mJ with a power of 25W in the dynamic operating mode.

The combination of devices allowed the scar to show clinical improvements in pliability, vascularity and volume.

## Early Postoperative Treatment of Surgical Scars Using a Fractional Carbon Dioxide Laser: A Split-Scar, Evaluator-Blinded Study

Lee SH, Zheng Z, Roh MR. Early Postoperative Treatment of Surgical Scars Using a Fractional Carbon Dioxide Laser: A Split-Scar, Evaluator-Blinded Study. *Dermatologic Surgery*. 2013;39(8):1190-1196. doi:10.1111/dsu.12228

Half the scar was treated two times in two week intervals approximately 3 weeks after surgery.

The laser treated half of the scar healed 50% better than the control area.

There were also significantly increased improvements noted in scar thickness and texture on the laser treated side which corresponded with patient satisfaction.

## Early Postoperative Treatment of Thyroidectomy Scars Using a Fractional Carbon Dioxide Laser

Jung JY, JeongJJ, RohHJ, et al. Early Postoperative Treatment of Thyroidectomy Scars Using a Fractional Carbon Dioxide Laser. *Dermatologic Surgery*. 2011;37(2):217-223. doi:10.1111/j.1524-4725.2010.01853.x

Patients underwent a single treatment with two passes of the laser between 2-3 weeks following surgery.

Laser parameters were set to a pulse energy of 50mJ and a density of 100spots/cm2.

A majority of patients showed more than 51% improvement in their scars.

91.3% of subjects reported they were satisfied with their results.

## **Effects Of Ablative 10,600-Nm Carbon Dioxide Fractional Laser Therapy On Suppurative Diseases Of The Skin: A Case Series Of 12 Patients**

Cho SB, Jung JY, Ryu DJ, Lee SJ, Lee JH. Effects Of Ablative 10,600-Nm Carbon Dioxide Fractional Laser Therapy On Suppurative Diseases Of The Skin: A Case Series Of 12 Patients. *Lasers in Surgery and Medicine*. 2009;41(8):550-554. doi:10.1002/lsm.20802

Patients received 1-3 sessions with the device.

Laser parameters treating specifically the lesions included a 70-90mJ pulse energy, a density of 100 spots/cm2 while in static operating mode.

Additional treatments utilized a pulse energy of 50-70mJ with a 100spots/cm2 density in static operating mode on the inflammatory papules and nodules.

100% of subjects showed improvement in the number of suppurative lesions.

100% of patients demonstrated an improvement in their overall skin pattern.

## **Efficacy And Safety Of Moisturizer Containing 5% Panthenol, Madecassoside, And Copper-Zinc-Manganese Versus 0.02% Triamcinolone Acetonide Cream In Decreasing Adverse Reaction And Downtime After Ablative Fractional Carbon Dioxide Laser Resurfacing: A Split-Face, Double-Blinded, Randomized, Controlled Trial**

Lueangarun S, Srituravanit A, Tempark T. Efficacy And Safety Of Moisturizer Containing 5% Panthenol, Madecassoside, And Copper-Zinc-Manganese Versus 0.02% Triamcinolone Acetonide Cream In Decreasing Adverse Reaction And Downtime After Ablative Fractional Carbon Dioxide Laser Resurfacing: A Split-Face, Double-Blinded, Randomized, Controlled Trial. *Journal of Cosmetic Dermatology*. 2019;18(6):1751-1757. doi:10.1111/jocd.12951

Subjects were treated with eCO2 on both sides of the face and then a different post-treatment regimen for each half for the next 7 days.

Laser parameters were set to a 120um tip, a 30W peak power, 50mJ pulse energy for a 1mm ablation depth with two passes and 100spots/cm2.

The use of specific creams can reduce the swelling, redness, crusting, and scaling often seen post laser.

## **Efficacy of bleomycin application on periungual warts after treatment with ablative carbon dioxide fractional laser: a pilot study**

Suh JH, Lee SK, Kim MS, Lee UH. Efficacy of bleomycin application on periungual warts after treatment with ablative carbon dioxide fractional laser: a pilot study. *Journal of Dermatological Treatment*. 2020;31(4):410-414. doi:10.1080/09546634.2019.1605136

Patients received a treatment every two weeks with the eCO2 followed by application of bleomycin until lesions were cleared.

Laser parameters were set to 180mJ pulse energy with 100 spots/cm2 in static mode.

68.4% of the lesions achieved complete clearance with no recurrence noted over the following 6 months.

## **Efficacy Of MAS063Dp Lotion Vs 0.02% Triamcinolone Acetonide Lotion In Improving Post-Ablative Fractional Co2 Laser Resurfacing Wound Healing: A Split-Face, Triple-Blinded, Randomized, Controlled Trial**

Lueangarun S, Tempark T. Efficacy Of MAS063Dp Lotion Vs 0.02% Triamcinolone Acetonide Lotion In Improving Post-Ablative Fractional Co2 Laser Resurfacing Wound Healing: A Split-Face, Triple-Blinded, Randomized, Controlled Trial. *International Journal of Dermatology*. 2018;57(4):480-487. doi:10.1111/ijd.13922

Patients were treated on both sides of the face with a pulse energy of 30mJ with a density of 100 spots/cm2 and static operating mode followed by application of two different lotions on each half of the face.

Results are discussed only on the basis of the effect of the lotions and their effect on post treatment subject reaction.

## **Efficiency of Carbon Dioxide Fractional Laser in Skin Resurfacing**

Petrov A. Efficiency of Carbon Dioxide Fractional Laser in Skin Resurfacing. *Open Access Macedonian Journal of Medical Sciences*. 2016;4(2):271-276. doi:10.3889/oamjms.2016.062

Treatment groups included a control, an eCO2 only group, and an eCO2 plus PRP.

89.3% of subjects that were treated reported they were satisfied with their improvement in acne scars.

85.7% of subjects treated for skin rejuvenation were satisfied with their results.

## **Evaluation of Efficacy of Fractional CO2 Laser in Acne Scar**

Saryazdi S, Mohebbi A. Evaluation of Efficacy of Fractional CO2 Laser in Acne Scar. *J Lasers Med Sci* 2012; 3(2):56-60

Subjects underwent three treatments every month.

For the first session, subjects were treated with a density of 150 spots/cm2 and a pulse energy of 70mJ in static mode for the depressed acne scars.

For the rest of the first and the additional two treatments, the laser density was set to 100 spots/cm2 and a pulse energy of 70mJ in static mode.

After a single treatment session, subjects demonstrated up to a 25% reduction of depth and size of scars.

After completion of treatments the subjects demonstrated up to a 70% improvement with significant improvement in skin texture.

## **Fractional Carbon Dioxide Laser For The Treatment Of Facial Atrophic Acne Scars: Prospective Clinical Trial With Short And Long-Term Evaluation**

Elcin G, Yalici-Armagan B. Fractional carbon dioxide laser for the treatment of facial atrophic acne scars: prospective clinical trial with short and long-term evaluation. *Lasers in Medical Science*. 2017;32(9):2047-2054. doi:10.1007/s10103-017-2322-7

Treatments were completed with a 120um spot size, a density of 75-100 spots/cm2, a power of 30W, and pulse energy between 100-160mJ adjusted based on severity of the scars.

80.6% of patients reported themselves as improved following treatment.

Mild improvement is maintained even up to 3 years post treatment.

## **Fractional Carbon Dioxide Laser in Treatment of Acne Scars**

Petrov A, Pljakovska V. Fractional Carbon Dioxide Laser in Treatment of Acne Scars. *Open Access Macedonian Journal of Medical Sciences*. 2016;4(1):38-42. doi:10.3889/oamjms.2016.004

Treatments were completed based on patient results using either the 120 or 300nm beam.

Patients received at least three treatments and up to five in the case of rolling acne scars.



The most common type of acne scar was ice pick which improved by 46% on average.  
All types of acne scars saw significant improvement.

## **Fractional Carbon Dioxide Laser Resurfacing in Combination With Potent Topical Corticosteroids for Hypertrophic Burn Scars in the Pediatric Age Group: An Open Label Study**

Majid I, Imran S. Fractional Carbon Dioxide Laser Resurfacing in Combination With Potent Topical Corticosteroids for Hypertrophic Burn Scars in the Pediatric Age Group: An Open Label Study. *Dermatologic Surgery*. 2018;44(8):1102-1108. doi:10.1097/DSS.0000000000001413

The patients received 3-5 sessions of eCO2 in 1 month intervals, with triamcinolone suspension applied immediately after laser treatment.

Laser parameters were set a pulse energy of 90-150mJ with a 0W power.

80% of subjects presented with at least a 4 point reduction in their Vancouver Scar Scale scores.

90% of patients reported either a good or excellent response to the treatment.

## **Fractional Carbon-Dioxide Laser Plus Topical Clotrimazole versus Oral Itraconazole plus Topical Clotrimazole for Onychomycosis: A Randomized, Controlled Trial**

Chau TV, Mai LP, Nguyen HT, et al. Fractional Carbon-Dioxide Laser Plus Topical Clotrimazole versus Oral Itraconazole plus Topical Clotrimazole for Onychomycosis: A Randomized, Controlled Trial. *Open Dermatology Journal*. 2020;14(1):16-21. doi:10.2174/1874372202014010016

Subjects received an eCO2 treatment every two weeks alongside twice-daily clotrimazole cream.

Laser parameters were set to a pulse energy between 10-15mJ, a density of 10% with a pulse interval of 0.5ms and a pulse width of 0.5-1.0ms.

73% of patients treated by the laser were able to achieve a negative KOH examination.

A statistically significant improvement of 5.1 points assessed by SCIO index was seen in laser treated subjects.

## **Fractional CO2 laser is as effective as pulsed dye laser for the treatment of hypertrophic scars**

Radmanesh M, Mehramiri S, Radmanesh R. Fractional CO2 laser is as effective as pulsed dye laser for the treatment of hypertrophic scars. *Journal of Dermatological Treatment*. 2021;32(6):576-579. doi:10.1080/09546634.2019.1687821

Either one scar or part of a scar were treated four times with the eCO2 for a total of 3 passes.

Laser parameters were set to a power of 30W, a pulse energy of 50mJ and a density of 200 spots/cm2.

Mean vancouver scar scale improved from 7.3 to 4.3 for an average improvement of 41%.

eCO2 showed more beneficial effects on hyperpigmented scars compared to skin colored scars.

## **Fractional CO2 laser to improve noticeable scars after skin cancer surgery: An appraisal by the patients, laypersons, and experts**

Wyss N, Graf N, Hafner J, Imhof L. Fractional CO2 laser to improve noticeable scars after skin cancer surgery: An appraisal by the patients, laypersons, and experts. *Dermatologic Therapy*. 2021;34(4). doi:10.1111/dth.14999

Lesions were treated with the device with a pulse energy of 40-60mJ in static mode, 120 spots/cm2 with two passes.

Patient assessment of scar severity improved from 3/10 to 7/10 post treatment.  
Expert and layperson photo grading indicated significant improvement from 4/10 to 7/10 post treatment.

### **Fractional CO2 laser treatment for post-surgical lip scars in cleft lip and palate patients**

Jahanbin A, Eslami N, Layegh P, et al. Fractional CO2 laser treatment for post-surgical lip scars in cleft lip and palate patients. *Lasers in Medical Science*. 2019;34(8):1699-1703. doi:10.1007/s10103-019-02819-z

Subjects underwent five treatments in one month intervals.

Laser was set to static mode with a power of 30W for two passes.

The first pass had a density of 150 spots/cm2 increased to 200 spots/cm2 with a pulse energy of 40mJ.

The appearance, symptoms, patient scar consciousness and total improvement all saw significant clinical benefit from the last treatment.

EMG recordings showed significant decrease in activity at rest and maximum lip compression.

### **Fractional Transepidermal Delivery: A Histological Analysis**

Beltraminelli H, Dietrich N, Hunziker T. Fractional Transepidermal Delivery: A Histological Analysis. *Dermatology*. 2011;223(4):321-324. doi:10.1159/000334165

Laser was used on ex vivo human skin with a spot size ranging from 120-1,000um, a pulse energy of either 40 or 60mJ, a power of 5,10, or 20W and spot density of 51 or 151 spots/cm2.

Treatment with the laser caused epidermal necrosis with a diameter of 300um and a maximum depth of 300um.

### **Intensified fractional CO2 laser-assisted photodynamic therapy vs. laser alone for organ transplant recipients with multiple actinic keratoses and wart-like lesions: a randomized half-side comparative trial on dorsal hands**

Helsing P, Togsverd-Bo K, Veierød MB, Mørk G, Hædersdal M. Intensified fractional CO2 laser-assisted photodynamic therapy vs. laser alone for organ transplant recipients with multiple actinic keratoses and wart-like lesions: a randomized half-side comparative trial on dorsal hands. *British Journal of Dermatology*. 2013;169(5):1087-1092. doi:10.1111/bjd.12507

The eCO2 was utilized with a 120um spot size with a power of 30W with two passes, first targeting the lesions and then a general treatment area pass.

First pass on lesions was with a 160mJ pulse energy, and 6.26ms pulse duration and then second pass with 140mJ pulse energy and 5.65ms pulse duration

eCO2 was able to improve 52% of the lower grade lesions with complete clearance in 31%.

PDT combined with eCO2 was able to clear 73% of lesions and improve 82%.

### **Lower-Fluence, Higher-Density versus Higher-Fluence, Lower-Density Treatment with a 10,600-nm Carbon Dioxide Fractional Laser System: A Split-Face, Evaluator-Blinded Study**

Jung JY, Lee JH, Ryu DJ, et al. Lower-Fluence, Higher-Density versus Higher-Fluence, Lower-Density Treatment with a 10,600-nm Carbon Dioxide Fractional Laser System: A Split-Face, Evaluator-Blinded Study. *Dermatologic Surgery*. 2010;36(12):2022-2029. doi:10.1111/j.1524-4725.2010.01803.x

Subjects received a single treatment with eCO2 with each half of the face treated with different parameters.



# LUTRONIC<sup>®</sup> eCO2 Bibliography

## Intelligent Care<sup>™</sup>

One half of the face was treated with a pulse energy of 70mJ and a density of 150 spots/cm<sup>2</sup>, the other half was treated with 30mJ pulse energy and a density of 250 spots/cm<sup>2</sup>.

High energy with lower density eCO2 settings resulted in half of patients presenting with clinical improvement higher than 75%.

100% of subjects were satisfied with the results from the high energy low density protocol.

### Multimodal Management of Atrophic Acne Scarring in the Aging Face

O'Daniel T. Multimodal Management of Atrophic Acne Scarring in the Aging Face. *Aesthetic Plastic Surgery*. April 2011:epub. doi:10.1007/s00266-011-9715-y

No specific parameters are discussed in the publication.

Multimodal treatments allow you to treat multiple aspects of underlying conditions.

### Non-Ablative 1550 nm Erbium-Glass and Ablative 10,600 nm Carbon Dioxide Fractional Lasers for Various Types of Scars in Asian People: Evaluation of 100 Patients

Cho S, Jung JY, Shin JU, Lee JH. Non-Ablative 1550 nm Erbium-Glass and Ablative 10,600 nm Carbon Dioxide Fractional Lasers for Various Types of Scars in Asian People: Evaluation of 100 Patients. *Photomedicine and Laser Surgery*. 2014;32(1):42-46. doi:10.1089/pho.2013.3608

eCO2 or 1550 ErGlass laser were utilized depending on characteristics of the scars.

Laser parameters were set to a pulse energy of 25-32mJ, a spot density of 200 spots/cm<sup>2</sup> and either static or dynamic operating modes.

The mean grade of improvement based on clinical assessment for the eCO2 treated scars was 2.60.

94% of patients across all scar types showed at least moderate improvement.

### Objective analysis of volume restoration in atrophic acne scars and skin pores: a split study using human stem cell-conditioned media

Park CS, Park J-H, Kim CR, Lee JH. Objective analysis of volume restoration in atrophic acne scars and skin pores: a split study using human stem cell-conditioned media. *Journal of Dermatological Treatment*. 2021;32(1):73-77. doi:10.1080/09546634.2019.1628915

eCO2 was used to treat both cheeks of the patients.

Atrophic scar areas were treated with a pulse energy of 20-30mJ and a density of 400 per 120um in static mode.

Full cheeks were treated with 20mJ pulse energy and density of 200 per 400um in dynamic mode.

eCO2 significantly reduced the volume of the skin pores by 37.6% on the face.

Overall scar volume decreased by 23.5% following treatment.

### Onychodystrophy Treated Using Fractional Carbon Dioxide Laser Therapy and Topical Steroids: New Treatment Options for Nail Dystrophy

Lim E-H, Seo Y-J, Lee J-H, Im M. Onychodystrophy Treated Using Fractional Carbon Dioxide Laser Therapy and Topical Steroids: New Treatment Options for Nail Dystrophy. *Dermatologic Surgery*. 2013;39(12):1931-1933. doi:10.1111/dsu.12365

Treatments with the device were performed every four weeks with a single pass alongside daily use of desoximetasone lotion.

Significant clinical improvement was seen after three treatment sessions.

Subject did not report any adverse events outside of mild treatment pain.

## Photodynamic therapy with ablative carbon dioxide fractional laser in treatment of actinic keratosis

Jang YH, Lee DJ, Shin J, Kang HY, Lee E-S, Kim YC. Photodynamic therapy with ablative carbon dioxide fractional laser in treatment of actinic keratosis. *Annals of dermatology*. 2013;25(4):417-422. doi:10.5021/ad.2013.25.4.417

Lesions were treated with eCO2 with a pulse energy of 50mJ, spot density of 100 spots/cm2, power of 30W and a 120um spot size.

70.6% of the lesions showed a complete response within three treatments.

The average number of treatments to accomplish a complete response was 1.7.

## Post-It notepad as a simple tool to determine the approximate penetration depth of fractional ablative lasers

AlJasser MI, Al-Issa A, Ahmad RM. Post-It notepad as a simple tool to determine the approximate penetration depth of fractional ablative lasers. *Journal of the American Academy of Dermatology*. 2020;83(6):e393-e394. doi:10.1016/j.jaad.2019.07.058

Laser parameters were set to a 50mJ pulse energy, density of 150 spots/cm2 and 120um spot size and then shot into a stack of post-it notes.

Laser was able to delivery energy up to approximately 6 post-it notes.

## Prospective Evaluation of Fractional CO2 Laser Treatment of Mature Burn Scars

Blome-Eberwein S, Gogal C, Weiss MJ, Boorse D, Pagella P. Prospective Evaluation of Fractional CO2 Laser Treatment of Mature Burn Scars. *Journal of Burn Care & Research*. 2016;37(6):379-387. doi:10.1097/BCR.0000000000000383

Three eCO2 treatments were completed with a pulse energy ranging from 40-90mJ and density of 100-150 spots/cm2.

eCO2 was able to significantly improve the objectively measured thickness, sensation, erythema and pigmentation of treated scars.

## Randomized, Controlled Early Intervention of Dynamic Mode Fractional Ablative CO2 Laser on Acute Burn Injuries for Prevention of Pathological Scarring

Waibel JS, Gianatasio C, Rudnick A. Randomized, Controlled Early Intervention of Dynamic Mode Fractional Ablative CO2 Laser on Acute Burn Injuries for Prevention of Pathological Scarring. *Lasers in Surgery and Medicine*. 2020;52(2):117-124. doi:10.1002/lsm.23170

Three treatments were performed with 8 week intervals.

Laser treatments were performed with a spot size of 120um in dynamic mode.

Blinded evaluators were able to pick out the treated areas compared to control 100% of the time.

Scar severity decreased by an average of 63% versus control.

## Rapid Healing and Reduced Erythema after Ablative Fractional Carbon Dioxide Laser Resurfacing Combined with the Application of Autologous Platelet-Rich Plasma

Na JJ, Choi JW, Choi HR, et al. Rapid Healing and Reduced Erythema after Ablative Fractional Carbon Dioxide Laser Resurfacing Combined with the Application of Autologous Platelet-Rich Plasma. *Dermatologic Surgery*. 2011;37(4):463-468. doi:10.1111/j.1524-4725.2011.01916.x

Subjects were treated with eCO2 then had PRP applied to a random arm.  
Pulse energy for treatments was set to either 10 or 20mJ with a consistent spot density of 150 spots/cm<sup>2</sup>.

PRP dramatically increased the speed of transepidermal water loss.

PRP reduced post-treatment downtime and adverse effects.

### **Refractory Pyoderma Gangrenosum Effectively Treated Using a 10,600-nm Carbon Dioxide Fractional Laser**

*Park J, Choi MJ, Goo B, Cho SB. Refractory Pyoderma Gangrenosum Effectively Treated Using a 10,600-nm Carbon Dioxide Fractional Laser. Dermatologic Surgery. 2013;39:477-479. doi:10.1111/dsu.12020*

Subject was treated with eCO2 four times in two week intervals.

Laser parameters included a pulse energy set to 80mJ delivered in two passes with a density of 150 spots/cm<sup>2</sup>.

Skin lesion showed marked improvement after two sessions and was nearly fully healed after three.

Five months following final treatment there was no noted regression of improvement.

### **Short flap rhytidectomy and fractional CO2 laser rejuvenation of the aging face**

*Taghizadeh F, Leibowitz A, Ellison T, Griego M, Traylor-Knowles M, Ramirez P. Short flap rhytidectomy and fractional CO2 laser rejuvenation of the aging face. Journal of Cosmetic Dermatology. 2013;12(1):49-56. doi:10.1111/jocd.12018*

Subjects received a rhytidectomy which was shortly followed by up to 4 sessions of eCO2 treatment.

Treatment parameters were standardized to a density of 100 spots/cm<sup>2</sup> and a pulse energy of 60-110mJ.

One year post treatment there was no regression in patient satisfaction from the treatment.

### **Silicone-Induced Foreign Body Reaction of the Face Successfully Treated Using Nonablative 1,550-nm Erbium-Glass and Ablative 10,600-nm Carbon Dioxide Fractional Lasers**

*Cho S, Jung JY, Shin JU, Lee JH. Silicone-Induced Foreign Body Reaction of the Face Successfully Treated Using Nonablative 1,550-nm Erbium-Glass and Ablative 10,600-nm Carbon Dioxide Fractional Lasers. Dermatologic Surgery. 2012;38(10):1744-1746. doi:10.1111/j.1524-4725.2012.02523.x*

The patient was treated in two month intervals with treatment by 1,550Er:Glass followed by eCO2 treatment.

eCO2 treatment settings were a pulse energy of 100-140mJ and 100 spots/cm<sup>2</sup> in static mode.

Clinical improvement was seen after five sessions in which the lesions significantly decreased and softened.

All side effects were transient and resolved within a week.

### **Skin-tightening effect of fractional lasers: Comparison of non-ablative and ablative fractional lasers in animal models**

*Park SH, Kim DW, Jeong T. Skin-tightening effect of fractional lasers: Comparison of non-ablative and ablative fractional lasers in animal models. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2012;65(10):1305-1311. doi:10.1016/j.bjps.2012.04.028*

Treatments were completed every 3 weeks for a total of four sessions.

Mice were treated with a pulse energy of 80mJ and a density of 150 pulse/cm<sup>2</sup>.

The use of eCO2 caused an immediate shrinkage in skin of 11.5% which maintained at 9% up to 4 months after treatment.

### Surface Treatment with a fractional CO2 Laser Enhances Shear Bond Strength of Resin Cement to Zirconia

Ahrari F, Boruziniat A, Alirezaei M. Surface treatment with a fractional CO2 laser enhances shear bond strength of resin cement to zirconia. *Laser therapy : an international journal of low level laser therapy and photobioactivation*. 2016;25(1):19-26. doi:10.5978/islsm.16-OR-01

Laser was applied to three different groups at different parameters.

The first laser group was treated at a power of 10W and pulse energy of 10mJ, the next group was 10W and 14mJ, and the final group at 20W and 10mJ.

Shear bond strength was significantly improved by the use of the eCO2 device.

### Surgical Treatment of Chronic Hidradenitis Suppurativa: CO2 Laser Stripping—Second Intention Technique

Crocco EI, Dalapicola MC, Suzuki NM, Alves RO. Surgical Treatment of Chronic Hidradenitis Suppurativa: CO2 Laser Stripping—Second Intention Technique. *Dermatologic Surgery*. 2016;42(3):429-431. doi:10.1097/DSS.0000000000000637

Subjects were treated up to 3 times with the 120um tip, dynamic mode, a power of 30W, and a pulse energy of either 60 or 240mJ.

The use of the eCO2 device was effective in treating Hidradenitis Suppurativa.

### Targeted laser reconstruction of skin scars using 10 600-nm carbon dioxide fractional laser

Lee SJ, Choi MJ, Chung WS, Cho SB. Targeted laser reconstruction of skin scars using 10600-nm carbon dioxide fractional laser. *Journal of Cosmetic and Laser Therapy*. 2012;14(2):87-88. doi:10.3109/14764172.2012.670705

Atrophic scars for each patient were treated with a pulse energy of 100mJ and a density of 100 spots/cm2 in one month intervals.

The treatment reduced the overall downtime for patients while maximizing the results.

### The combination of copper bromide laser, a 10600 nm ablative carbon dioxide laser and intralesional triamcinolone for the treatment of hypertrophic thyroidectomy scars

Kim JH, Kim HJ, Kim YH, et al. The combination of copper bromide laser, a 10 600 nm ablative carbon dioxide laser and intralesional triamcinolone for the treatment of hypertrophic thyroidectomy scars. *Journal of the European Academy of Dermatology and Venereology*. 2011;26(1):125-126. doi:10.1111/j.1468-3083.2011.04025.x

Patients underwent two treatment sessions four weeks apart, which could have included any treatment modality of eCO2, CBL, or intralesional TA.

eCO2 was particularly effective in improving the thickness and pliability of the scars.

### The effect of fractional carbon dioxide lasers on idiopathic guttate hypomelanosis: a preliminary study

Shin J, Kim M, Park SH, Oh SH. The effect of fractional carbon dioxide lasers on idiopathic guttate hypomelanosis: a preliminary study. *Journal of the European Academy of Dermatology and Venereology*. 2013;27(2):e243-e246. doi:10.1111/j.1468-3083.2012.04597.x

Patients were treated a single time with a 100 mJ pulse energy and spot density of 150 spots/cm2 in static mode.

Two blinded evaluators graded that 90% of subjects had at least a 50% improvement.

82.5% of patients were satisfied after only one treatment.

## **The effect of human umbilical cord blood–derived mesenchymal stem cell media containing serum on recovery after laser treatment: A double-blinded, randomized, split-face controlled study**

Kim J, Kim B, Kim S, Lee YI, Kim J, Lee JH. The effect of human umbilical cord blood–derived mesenchymal stem cell media containing serum on recovery after laser treatment: A double-blinded, randomized, split-face controlled study. *Journal of Cosmetic Dermatology*. 2020;19(3):651-656. doi:10.1111/jocd.13063

Laser was set to a pulse energy setting of 70mJ with a density of 100 spots/cm<sup>2</sup> followed shortly after with the application of hUCBMSC

The serum was capable of reducing the number of regions with microcrusts and erythema

## **The effect of succinylated atelocollagen and ablative fractional resurfacing laser on striae distensae**

Shin JU, Roh MR, Rah DK, Ae NK, Suh H, Chung KY. The effect of succinylated atelocollagen and ablative fractional resurfacing laser on striae distensae. *Journal of Dermatological Treatment*. 2011;22(2):113-121. doi:10.3109/09546630903476902

Three treatments every four weeks were completed with the eCO2 device.

Treatments were delivered with a pulse energy of 50 mJ and a spot density of 200 spots/cm<sup>2</sup>.

Clinically significant improvement was seen on the treated striae distensae with and without atelocollagen.

## **The Use of Locally Applied Vibration to Minimize Pain during Fractional CO 2 Laser Therapy in Living Liver-Donor Scar Management**

Song S, Choi DH, Oh TS. The Use of Locally Applied Vibration to Minimize Pain during Fractional CO 2 Laser Therapy in Living Liver-Donor Scar Management. *Archives of Plastic Surgery*. 2016;43(6):570-574. doi:10.5999/aps.2016.43.6.570

Treatment was conducted 4 months post liver extraction to treat abdomen scars.

Laser parameters were set to a power of 30W, a density of 150 spots/cm<sup>2</sup>, and a pulse energy between 120-160mJ.

Subjects reported a pain score of 6.1/10 during treatment which was reduced to 4.6/10 when using vibrating device.

## **Toenail onychomycosis treated with a fractional carbon-dioxide laser and topical antifungal cream**

Lim EH, Kim HR, Park YO, et al. Toenail onychomycosis treated with a fractional carbon-dioxide laser and topical antifungal cream. *Journal of the American Academy of Dermatology*. 2014;70(5):918-923. doi:10.1016/j.jaad.2014.01.893

Laser treatment was performed three times in one month intervals alongside topical antifungal cream.

Laser parameters were set to a pulse energy of 160mJ, a density of 150 spots/cm<sup>2</sup>, with either 2 or 3 passes per session.

92% of patients showed a clinical response to the treatment.

50% of subjects had complete response with a negative microscopic result as well.

## **Treatment of Striae Distensae with Nonablative Fractional Laser versus Ablative CO(2) Fractional Laser: A Randomized Controlled Trial**

Yang YJ, Lee G-Y. Treatment of Striae Distensae with Nonablative Fractional Laser versus Ablative CO(2) Fractional Laser: A Randomized Controlled Trial. *Annals of dermatology*. 2011;23(4):481-489. doi:10.5021/ad.2011.23.4.481

Lesion was split and treated three times every month with a 1,550Er:Glass and eCO2.

Laser parameters were set to a pulse energy of 40-50mJ and spot density of 75-100 spots/cm<sup>2</sup> in static mode.

Elasticity of the treated area improved significantly by 23% on average.

Width of the treatment area improved significantly by 29.7% on average.

**Treatment of Syringoma Using an Ablative 10,600-nm Carbon Dioxide Fractional Laser: A Prospective Analysis of 35 Patients**

Cho SB, Kim HJ, Noh S, et al. Treatment of Syringoma Using an Ablative 10,600-nm Carbon Dioxide Fractional Laser: A Prospective Analysis of 35 Patients. *Dermatologic Surgery*. 2011;37(4):433-438. doi:10.1111/j.1524-4725.2011.01915.x

Two sessions of eCO2 were performed in one month intervals on the periorbital syringomas. Laser parameters were set to a pulse energy of 100mJ and a density of 100 spots/cm2.

85.5% of subjects were satisfied with their results.

A majority of patients showed at least 50% improvement two months post treatment.

**Up-regulation of fibroblast growth factor (FGF) 9 expression and FGF-WNT/ $\beta$ -catenin signaling in laser-induced wound healing**

Zheng Z, Kang H, Lee S, Kang S, Goo B, Cho SB. Up-regulation of fibroblast growth factor (FGF) 9 expression and FGF-WNT/ $\beta$ -catenin signaling in laser-induced wound healing. *Wound Repair and Regeneration*. 2014;22(5):660-665. doi:10.1111/wrr.12212

Mice were treated with a single session of eCO2 at a pulse energy of 50mJ and a density of 200 spots/cm2 in a single pass.

Histology noted a marked increase in dermal thickness and dermis fibroblasts.

Laser treatment resulted in a significant overexpression of FGF0 and FGF9 mRNA in mouse and human skin.