JetPeel: A New Technology for Facial Rejuvenation

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Abstract: JetPeel (Tav-Tech Ltd., Yehud, Israel) is a new device for cosmetic resurfacing of the facial skin. It uses a new technology of a 2-phase stream that creates a jet composed of gas (oxygen) and microdroplets of fluid (saline) accelerated to supersonic velocities. This jet impacts the skin, causing gentle and accurate cosmetic peeling.

Our preclinical and clinical experience with the JetPeel for rejuvenation of the face is presented. In a group of 50 patients, we found the JetPeel technology to be a safe and effective new tool for the usual indications for facial peeling. It was most useful and effective for perioral peel. JetPeel can be used in combination with other resurfacing modalities such as chemical peeling or laser.

Further investigation is needed to explore other applications of this technology, such as using different combinations of gases and fluids and transdermal transfer of medication dissolved in the peeling jet.

Key Words: cosmetic surgery, facial rejuvenation, peeling, dermabrasion, JetPeel


The desire to rejuvenate the skin is very old and dates back to the era of ancient Egypt-Ebers papyrus (1560 BC). Early resurfacing techniques involved direct application of minerals, plant extracts, sulfur, mustard, or limestone. Renewed interest for facial skin resurfacing was noted among physicians and surgeons in the early 20th century. McKee and Karp (1903) were the first to report their experience with liquid phenol in the treatment of acne scars. Kromayer (1905) is considered the first to apply mechanical dermabrasion techniques using rotating wheels and rasps. After World War II, lay peelers developed new techniques using mainly trichloroacetate and phenol. Skepticism of the medical society gradually resolved in the 1960s, with data from numerous studies showing the clinical effectiveness and histologic changes in the skin associated with chemical peeling.

Since the early 1990s, various types of lasers have been used to resurface photo-aged skin. CO₂ laser was first introduced in a nationwide presentation by Roberts in 1995. Since then, technologies have been changing, and the clinical use has expanded rapidly throughout the world.

This article introduces a novel method for skin resurfacing. The JetPeel device is based on a new technology derived from the world of aviation. A mixture of sterile saline and oxygen passes through an open converging-diverging venturi channel, designed to produce supersonic flow accelerating the solution droplets to approximately 200 m/s, and exits through specialized nozzles as a powerful jet directly onto the desired area of skin. This high-energy microdroplet spray gently exfoliates the skin. After removing the epidermal layer, additional layers of the upper papillary dermis can be removed accurately to reach the desired end point depth as set by the operator.

Study Objectives

Our objectives were to determine the safety and the efficacy of the JetPeel system as a peeling modality in a preclinical setting and to determine the clinical results and patient satisfaction with the procedure.

MATERIALS AND METHODS

The Technology

The idea behind the JetPeel is derived from the world of aviation using supersonic flow in nozzles. Liquid medium is propelled by subatmospheric pressure caused by the rapid flow through a parallel capillary tube. The mixture of liquid and gas is accelerated in an open converging-diverging venturi channel to reach high velocity using a 2-phase stream and emits through a specially designed nozzle unit. The jet spray impacts on the skin, causing shearing forces strong enough to peel the epidermal and dermal layers of skin as necessary.

The Device

The device used in this study is the JetPeel system manufactured by TavTech Ltd (Yehud, Israel). The JetPeel...
system is a portable device, which produces a spray of liquid mixed with gas under a predetermined pressure of 7 atm. The jet spray consists of liquid droplets, 5 to 200 μm in diameter, emitted at a speed of up to 200 m/s.

The JetPeel device consists of a control unit, a hand piece, a footswitch, and tubing line accessories. A source of pressurized oxygen (or any other gas, eg, nitrogen) is connected to the control unit set to yield a pressure of 7 atm. A disposable solution bag supplies the sterile liquid medium needed. The mixture of gas and fluid occurs inside a sterile, disposable hand piece. A separate suction hand piece removes gas and debris.

Peeling Technique
The hand piece is held by the operator at a 45° to 90° angle to the skin surface and at a distance of 2 to 5 mm from the skin. When the footswitch is pressed, the jet is released from the nozzles. Care is taken to avoid the eyes and the eyelids. When the jet is applied to the skin, a blanching effect is noticed, representing a momentary withdrawal of blood from the treated skin segment. This serves as an indicator for proper application of the jet. Gradually, the abrasive droplet attack creates enough mechanical energy for peeling of the epidermis. Slow scanning advancement of the jet stream is then begun along a line in a forward direction, exploiting the momentum of power, creating a “front” of peeling and achieving a uniform depth of removal. Areas for which the operator wishes to increase the depth of peeling are retreated in the same manner (for example: along the wrinkle creases in the perioral area). Punctate bleeding and its intensity after discontinuing the jet serve as an indicator for the peeling depth (Fig. 1).

Preclinical Study Design
Since the porcine model is the most closely analogous to human skin, it was used as the preliminary in vivo model. The porcine model has been well established in the scientific literature.11

Four porcine (Sus scrofa) of a local strain of Landrace × Large Whites, aged less than 2 years and weighing about 15 kg, were used as the experimental model.

After proper acclimatization, fasting, and sedation, general anesthesia was initiated. The back and flank of the anesthetized pigs were clipped, taking care not to cause injury to the skin, and then scrubbed according to standard aseptic practices for preparation of skin (iodine surgical scrub and alcohol rinse). A template was used to mark the experimental windows on each side of the back and flank of the swine.

Skin peeling technique was performed using the JetPeel system.

Full-thickness 8-mm punch biopsies were taken both immediately prior to the procedure and at 7 and 14 posttreatment days during the healing phase.

FIGURE 1. The technique of using the JetPeel system.

Evaluation was based on gross and microscopic examinations of the biopsies. The parameters examined included peeling depth, dermal inflammation and reepithelialization.

Clinical Study Design
The study group consisted of 50 healthy adult volunteers seeking esthetic improvement who agreed to participate in our study. The study was conducted in accordance with the Helsinki committee regulations for human experiments.

The indications for treatment were sun-damaged skin, facial rhytids, pigmentation disorders, and postacne facial scarring. Periocular skin and eyelids were excluded from treatment.

For partial facial procedures, the treatment area was anesthetized locally using 5% eutectic mixture of local anesthetics (lidocaine and prilocaine) cream in all cases. Facial blocks using 2% lidocaine with 1:200,000 adrenaline were used as necessary. Full-face procedures were done under general anesthesia or IV sedation.

The skin was aseptically prepared and draped using a betadine solution mixed with normal saline at a ratio of 1:1. The procedure was continued until the end result as desired by the operator was reached, judged clinically by direct vision and the intensity of punctate bleeding.

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At the end of the procedure, petroleum jelly (Vaseline) was evenly applied to cover the entire treatment area. An open treatment regimen was used postoperatively, and the patients were instructed to cleanse the treated area with warm tap water and mild soap twice daily and then to apply a fresh thin layer of Vaseline.

All the patients were given oral acyclovir 200 mg 5 times daily from a day prior to the procedure until healing was complete.

RESULTS

Preclinical

Biopsies taken from the treated skin showed the effects of removing the epidermis and the upper dermis. Healing was uneventful, occurring from 7 to 14 days posttreatment. There were no wound healing complications (eg, infection, delayed healing, etc). Clinical and histologic examinations proved that the JetPeel achieved the desired peeling effect (Fig. 2).

Clinical

The study group consisted of 50 healthy adult volunteers, 40 females and 10 males (age 19–62 years; mean 38 years).

The indications for treatment were sun-damaged skin, facial rhytids, skin pigmentation, and postacne facial scarring.

Treatment areas were concealed retroauricular skin in the preliminary 10 cases, partial facial areas (especially perioral) in 32, and full-face peeling in 8.

Healing course was smooth and uneventful. Reepithelialization occurred within 7 to 9 days, depending on the depth and location of the area treated. Regular follow-up visits were scheduled at predetermined intervals, the longest follow-up to date being 24 months.

The overall length of treatment ranged from 5 to 70 minutes.

The healing phase was very smooth and easy. Erythema was noted during the first 2 to 4 weeks postpeeling. All the patients were instructed to abstain from the sun as much as possible and to use sunscreens with SPF ≥30 whenever sun exposure was inevitable.

The esthetic results as judged both by the patients and by the medical staff were good to excellent, and patient satisfaction was high (Figs. 3–6).

Complications

We noted only a few cases of complications, all of which were minor. One case of herpes simplex virus (HSV) infection was noted in a 40-year-old female with postacne

![FIGURE 2. Histologic examination of porcine skin treated with the JetPeel device. Level of peeling is at the papillary dermis (H&E X 4).](image)

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![FIGURE 3. Treatment results of the crow's feet. A, Pretreatment; B, posttreatment.](image)
scarring after a full-face jet peeling procedure despite preventive treatment with acyclovir. The patient was noticed to have pain, erythema, and some small vesicles on her face. The dose of acyclovir was increased to a therapeutic level given intravenously, and an antibiotic treatment was added. Healing was complete, with excellent results and no scarring (Fig. 5A, B).

Three cases of hyperpigmentation, presumably related to sun exposure, were treated conservatively with hydroquinone- and isotretinoin-based products, with satisfactory improvement.

One case of subcutaneous emphysema of the lower eyelid was encountered when the treatment was too close to the periocular area. The emphysema, although troublesome both to the surgeon and to the patient, subsided in 2 to 3 hours without any sequelae.

This unique complication is due to subcutaneous penetration and dissection of the jet stream in a very loose and thin type of skin. The best way to avoid it is to exclude areas of thin skin (usually the eyelids) from treatment and to use eye-blocking goggles as a means of protection from inadvertent passage of the jet to emphysematous-prone areas. The periocular area, especially the crow’s-feet region, is very well treated with the JetPeel device as long as the jet is applied.