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STEM CELL COMBINATION TARGETS FACE

Makeover for fat grafts

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Stem cell-enhanced FACELIFT

Stem cell rejuvenation has become such a well-worn phrase for claims made about procedures, skincare products and aesthetic treatments generally that it is in danger of losing its currency. In short, stem cells promote regeneration of organs and tissues.

In cosmetic surgery, stem cell rejuvenation usually refers to the cells contained in fat harvested by liposuction. While a few surgeons may have devised methods to isolate stem cells, tried and tested techniques are not yet in wide circulation, but that is only a matter of time.

Cytori's Celution system may hasten that development. Cytori is compiling and submitting a marketing application to the US Food and Drug Administration for the Celution 700 System for use as a medical device in aesthetic body contouring. Cytori develops and markets cell banking, therapeutic, and cosmetic medicine applications for its Celution system, which enables real-time regenerative cell therapy applications by harvesting and processing a small amount of patient-derived fat tissue in about one hour to harvest the adipose-derived stem and regenerative cells.

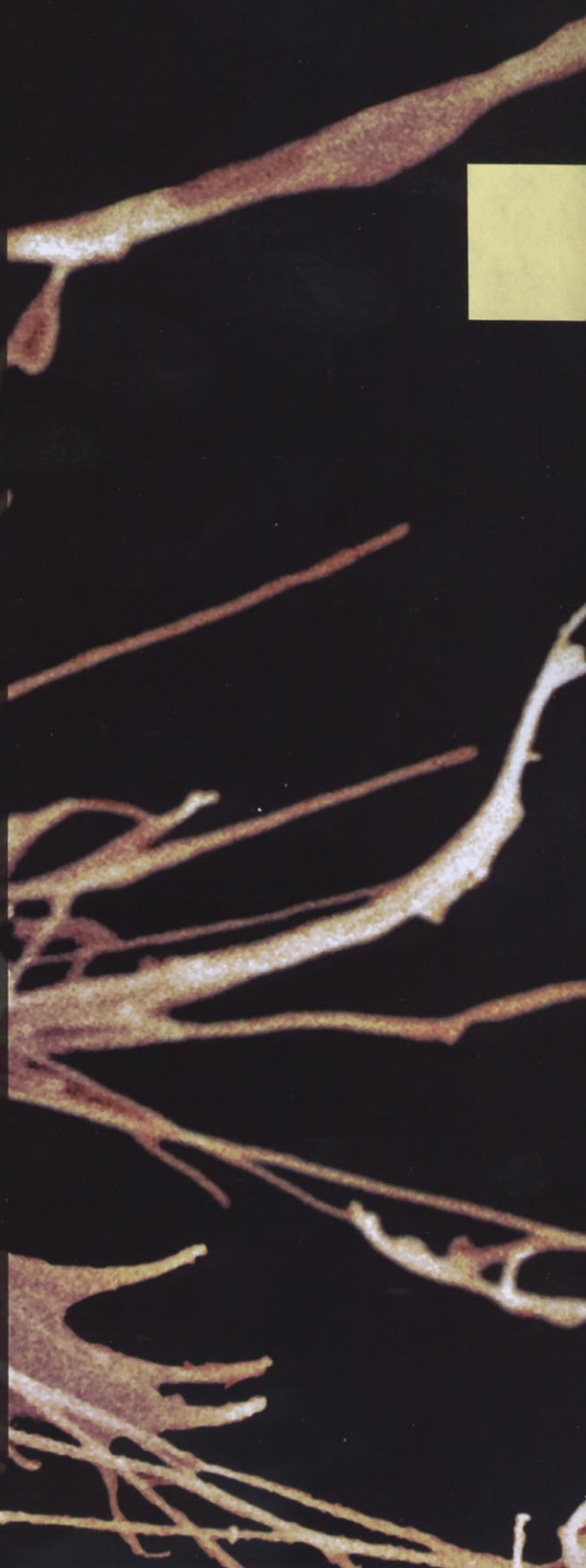
The Celution takes fat from the patient via a mini-liposuction and uses enzymes to break down the tissue, which is washed out to free cells that are then put back into the patient in one bedside procedure. According to Cytori, there are 30m–40m cells per 100cc of tissue extracted. The yield is about 5% stem cells along with others, including progenitor and endothelial cells. The cells release growth factors that prevent cell death and stimulate growth of new blood vessel formation.

Results

The stem cell-enhanced facelift is a volumising facial procedure combining a new generation facelift with a vertical vector (see "Vertical facelift", *Body Language* 15, Spring 2005). This avoids the classic wind-swept look of many traditional horizontal facelifts. The volumetric facelift not only restores facial volume but also adds regenerative cells, which are beneficial to rejuvenation. The cell-enriched grafting is injected into the superficial muscular aponeurotic system (SMAS) and underneath the facial musculature to create a more youthful look.

The procedure combines soft tissue transferred from one part of the body to the face with the patient's own adipose tissue-derived stem cells and regenerative cells. Fat grafting has been used in the past for a similar treatment. But the longevity of fat

The regenerative effects of stem cells harvested from liposuctioned fat may mark the start of a new age in aesthetic medicine. Facial surgery is already benefiting from advances made. **Dr Renato Calabria** discusses how he combines a vertical facelift with stem cell injection



grafting is unpredictable. It's technique-dependent and harder to perform. In some cases, if the patient gains weight, the face looks heavier.

Liposuctioned fat is rich with regenerative cells including adult stem cells, blood vessel-producing cells, growth factor-secreting cells. The cell-enhanced facelift first involves harvesting them—usually from the lower abdomen. Once the fat is harvested, the Celution is used to isolate these cells.

Adipose tissue is taken from the patient with a low volume tissue collection procedure using 10cc syringes. The collected tissue is then placed into the Celution device, which processes each patient's tissue.

The system liberates the stem and regenerative cells from the adipose matrix through an enzymatic process. The cells are then separated, washed and concentrated in the collection container. Processing takes place in a closed environment to minimise the risk of exposure to contaminants and can be completed within the time-frame of one surgical procedure.

A 1cc syringe is used to collect the cells that are to be redelivered to the patient. The cells can be injected directly into a site or implanted with a delivery matrix or scaffold to improve performance; for example, the cells can be combined with an adipose tissue graft depending on the volume needed.

A blunt needle with 80–100cc solution—containing 500cc saline, 1cc epinephrine 1–1000 and 50cc 1% plain xylocaine—delivers the solution to each side of the face. The elevation of the skin flap is done in a supraplatysmal plane with a Colorado tip with electrocautery to minimise bleeding.

The undermining is extensive over the lower orbicularis muscle, the zygomaticus major and minor, the SMAS, to the nasolabial fold and over the platysma in the neck. When needed, the buccal fat is excised.

Then plication sutures of 4–0 monocryl are placed in a horizontal line parallel with the medial and lateral orbicularis muscles with a vertical vector. The plication line forms a 90deg angle and more sutures are placed in a lateral vector down to the edge of the lateral platysma.

The critical part of the volumetric graft placement is then done. The cell-enhanced graft is placed in 1cc syringes with a Coleman blunt needle. The solution is injected under the orbicularis muscle (1–2cc) with multiple gentle passes, in the zygomatic area over the periosteum (6–9cc), under the zygomaticus muscles (1–2 cc) and under the SMAS (3–6cc).

It is also placed through a gengivobuccal approach in the

cheek area and the angle of the mandible area over the periosteum (3–9 cc). All placements are in high vascularised areas, without compromising the undermining of the skin flap.

The skin flaps are redraped in a more vertical vector anteriorly and posteriorly, excess skin is removed preserving anteriorly and posteriorly a dermal suspender flap. This is tunnelled and anchored with 3-0 vycril through separate 1cm incisions and incisions are closed with 4–0 and 5–0 prolene.

Once the cell-enhanced grafts are placed, symmetry is checked and the skin is redraped and approximated, excess skin excised, anchored in a vertical direction and closed in layers. The key is to place regenerative tissue in a precise location to enhance the volume of the face in areas previously volume-deprived.

Following reinfusion into the body, environmental cues from the damaged and surrounding tissue are thought to guide the stem and regenerative cells to the area of damage and help facilitate a natural healing response. The cells may respond in a variety of mechanisms promoting tissue survival, graft retention, or differentiation of progenitor cells into the appropriate cell type.

During the facelift, the regenerative cell tissue embedded in fat is placedwith a blunt cannula trough in multiple passes. The tissue is inserted in layers in the SMAS, under the orbicularis muscles, on the periosteum, in the zygomatic areas and, if needed, transbuccally in the angle of the mandible area to increase projection.

Once the fat is placed, symmetry is checked and the skin is redraped and approximated, excess skin excised and anchored in a vertical direction and closed in layers. The key is to place this regenerative tissue in a precise location to enhance the volume of the face in areas previously volume-deprived.

Skin

After the cell-enhanced facelift, the patient should show an improvement not only in the underlying soft tissue contouring of the face but also in the skin itself. The growth factors contained in these cells induce the skin and other tissues to produce more cells of their own. The growth factors initiate a signal to local and transplanted stem cells to restore themselves and multiply.

The regenerative cells, by secreting growth hormone and other factors, are beneficial to creating a more youthful look. The procedure can restore the youthful contour and shape of the face as well as skin tightness. The treatment can also even out colour irregularities caused by ageing and sun damage. The stem cell-enhanced face lift combines two modalities which ultimately have the potential not only to reposition the tissue and add volume to the face but also rejuvenate the skin at the cellular level.

Dr Renato Calabria is a cosmetic plastic surgeon based in Beverly Hills, California. W: www.drcalabria.com

Before and after the stem cell-enhanced facelift and an endoscopic brow-lift procedure

History of

1893 First clinical fat transplantation—German physician Franz Neuber used autologous fat harvested from the arm to augment depressed facial scars in the cheek following tubercular inflammation of the bone.

1895 Dr Karl Czerny carried out the first documented breast augmentation by transplanting a lipoma from patient's lumbar region to a breast defect.

1909 G M Verderame introduced fat injection into oculoplastic surgery. But most of the fat injected was reabsorbed by the body. E Lexer performed fat transplantation, using large pieces of fat which yielded better results.

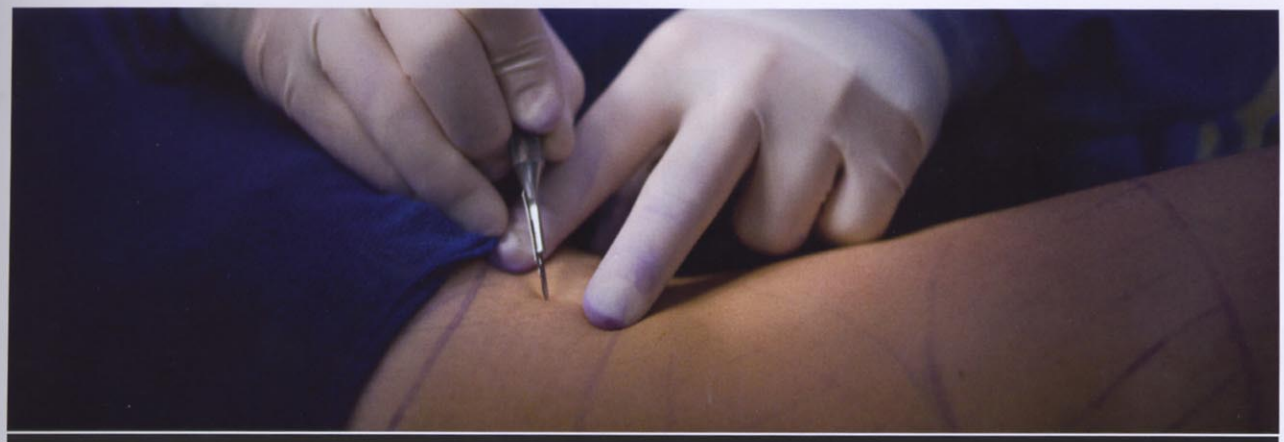
1911 Dr P Bruning placed small pieces of fat in a syringe and injected them into the nasal dorsum to correct post-rhinoplasty deformity.

1914 Lexer demonstrated his experience with the transfer of fat taken from the abdominal wall. Lexer also used the dermis to augment facial contours.

1926 Dr Charles Conrad Miller described infiltration of fatty tissue through hollow metal cannulas. He found better long-term correction and more natural effect with infiltrated fat than other methods of fat grafting.

1928 A Hilse was able to form adipose tissue from free fat grafts. He called histocytes filled with fat "lipoblasts"

1947 Green treated bone defects secondary to osteomyelitis using fat. He found that transplanted fat will undergo ossification and form connective tissue, raising the possibility of filling in defect regions.



REBUILDING THE BODY

While stem cells have been publicised for their potential to heal diseases such as heart failure and diabetes and address spinal cord injuries, they could also alter the landscape of aesthetic medicine. Natural alternatives for facial rejuvenation, breast augmentation and reconstructive surgery can provide practitioners with advanced options. So how can cosmetic practitioners use autologous stem cell therapy?

Stem cell therapy introduces certain advantages over conventional procedures, including less-invasive treatment, faster recovery and a higher success rate. As stem cells can develop into a range of cell types, they can help to repair wounds and regenerate tissue. Dr Chavdar Botev at the National Center of Haematology, Cell and Gene Therapy in Sofia, describes a case using autologous stem cells: "We had a patient who had absolutely no blood vessels because of trauma from an explosion. In this case, they applied implants twice which didn't graft as there was no blood supply."

The application of stem cells derived from bone marrow or adipose tissue can result in neoangiogenesis, or the development of new blood vessels. "If there are new vessels, we have a chance for grafting. So we applied the stem cells and after five months, it was obvious that the area was vasculated—when inserting a needle, there was blood. So the implant was then used and it was successful," Dr Botev says.

Stem cells have long been used in medicine to treat wounds and generate new cell growth. But the ability to regenerate skin opens up possibilities for anti-ageing. They can replenish specialised cells, such as those lost during ageing.

A 2008 Brazilian study found that certain areas of the body provide more viable sources of stem cells. Higher stem cell concentrations were found in fat extracted by liposuction from the lower abdomen and inner thighs. Each litre of fat can yield millions of potential cells, providing an infinite resource of stem cell material.

In one procedure, harvested stem cells can be separated from adipose tissue through a centrifuge. These cells can be reinjected into the face to treat depressed areas, wrinkles and acne scarring. With the patient acting as both donor and recipient, there is no rejection.

Facial rejuvenation is not the only area to benefit from using adipose-derived stem cells. Breast augmentation, combined with the liposuction to extract tissue, provide patients with a 'two-in-one" procedure. The concentration of stem cells ensures sufficient blood supply to the transplanted fat, promoting the growth of blood vessels in the area.

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1950 Dr Lyndon Peer experimented with autologous transplants in humans. He discovered that 50% of transplanted fat cells establish blood flow within a few days and survive for a year

1974 Doctors Arpad Fisher and his son Georgio discovered mechanical liposuction using a cannula and performed fat extraction

1982 Dr Mel Bircoll was the first to inject autologous fat from liposuction to augment the breast. He developed a facial contouring technique using liposuctioned fat

1984 Dr Yves-Gerard Illouz used fat extracted from liposuction to inject into face to correct skin defects. He found an abundant supply of adipose tissue

1986 Dr Richard Ellenbogen reported the use of free autogenous pearl fat grafts in atrophic and post-traumatic facial deficits

Dr Pierre Fournier reported to the ASDS that he had reinjected fat into 500 patients over a five months with no complications. He invented a technique for fat harvesting—microlipoinjection

1988 Dr Sydney Coleman presented his experiences with fat grafting to the American Society of Aesthetic Plastic Surgery annual meeting. He then began to transplant fat into iatrogenic liposuction deformities and then into faces

1995 Dr Sydney Coleman began injecting fat into the breasts using instruments developed for fat grafting