HAIR TRANSPLANT forum INTERNATIONAL

INTERNATIONAL SOCIETY OF HAIR RESTORATION SURGERY

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INSIDE THIS ISSUE

Use of porcine urinary bladder matrix in hair restoration surgery applications

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For the past two years, I have been working with a new wound healing product called ACell MatriStem™, an extracellular matrix (ECM) derived from porcine urinary bladder. I was introduced to the product by Dr. Gary Hitzig, who was just starting to explore its use as well. ACell is U.S. FDA–approved for management of topical wounds and is being used for wide-ranging medical applications, such as treating surgical wounds, war injuries, and even degenerative conditions. Following is a summary of the results of my preliminary studies with ACell that were presented at the October 2010 18th Annual Scientific Meeting of the ISHRS in Boston.

The ECM occupies the space between cells and is part of every organ and tissue of every animal species. ECM has "xenogenic transferability," meaning we can take ECM from various animals and use them in humans without fear of reactions because the makeup of animal ECM (e.g., cow, pig, horse) is so similar to that of humans. Use of ECM in surgery has been found to enhance wound healing, promote tissue regeneration, and inhibit scarring. There are numerous ECM products on the market today, but ACell is unique with its bilaminar structure and may therefore have distinct advantages compared to other products.

ACell MatriStem™ is composed of animal tissue that is processed to remove all cells, and irradiated with electron beams to completely sterilize the product. It is non-crosslinked, which allows it to naturally degrade with minimal inflammatory reaction. The unique bimodal surface has a basement membrane on one side, which is conducive to epithelial and endothelial cell attachment and differentiation. The other side, the mesenchymal tunica propria layer, facilitates integration into the wound bed and promotes vascular ingrowth. Studies have shown that ACell treatment of wounds inhibits fibrotic scarring and promotes angiogenesis. There is even evidence that progenitor cells are recruited to the wound to participate in tissue regeneration.[1]

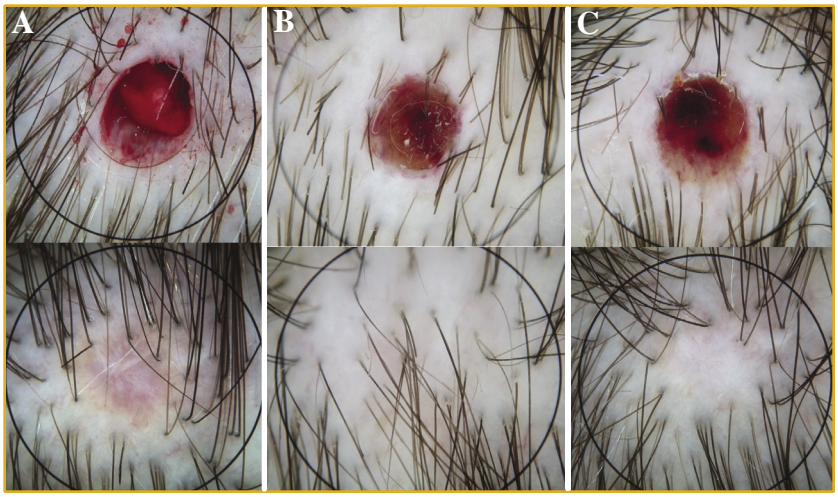

Figure 1. A: Control without ACell treatment shows fibrotic contracted scar. B: Punch (ACell treated) with surrounding transected follicles shows almost undetectable healing with hair regrowth. C: Punch (Acell treated) without transection shows smooth, hairless spot.

Looking closer at the components within the ACell product (porcine urinary bladder matrix), it has been found to contain:

- Structural Proteins
  - – Collagen types: I, II, III, IV, V, VI, VII
  - – Proteoglycans
- Growth Factors (VEGF, BMP4, PDGF-BB, KGF, TGFbeta1, IGF, bFGF, EGF, TGFalpha)
- Glycoproteins (laminin, elastin, fibronectin)
- Anti-Infective Peptides (18 AMPs have been identified in porcine tissue)
  - – Porcine defensin pBD-1

I began using ACell in the following areas of my hair restoration surgery practice: punch harvest sites (small FUE and larger); strip harvest donor healing; FU grafting; and autocloning with plucked hair.

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President's Message

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A recent study describes men who claim to have developed persistent sexual problems from taking finasteride, which continued even though they discontinued the medication. The media picked up on the story, simplified it to a few sound bites, and put it out there for public view, which terrified present and future finasteride patients everywhere. I'm calling this potential problem PSP-FTF (persistent sexual problems from taking finasteride) for short.

On the one hand, most of us have never seen PSP-FTF in our patients. How could a patient develop a permanent or persistent side effect that continues after a medication is discontinued? We feel as though a trusted friend has been wrongly accused of a horrible crime. Most of us have been strong proponents of finasteride in treating male pattern hair loss. We have seen hair loss stopped in its tracks, even some pleasing hair regrowth, all of which greatly enhances the results we achieve with the hair transplants we perform. Our patients look better, and as a result, so do we.

On the other hand, just because we have never seen it, doesn't mean it's not real. Every year, new strange marine life is discovered at the bottom of the ocean. We had no idea they existed until being brought up from the murky depths and photographed. And what about the Loch Ness Monster? There are those that passionately believe that this creature is real, too, even though the overwhelming majority don't. Is PSP-FTF rare but real, or is it imaginary? Here's a less fanciful analogy. In my dermatology training, we learned that oral ketoconazole could cause fatal hepatic failure in approximately 1 in 50,000. Although exceedingly rare and something I have never seen, I respect this side effect and take it into consideration when prescribing ketoconazole. On the other hand, there certainly seems to be situations where people wrongly blame their problems on medications they have taken, and they receive ample assistance from personal injury attorneys.

Another complicating factor is that sexual function is affected by thoughts, beliefs, and expectations. We know that a significant number of men in the clinical trials taking the placebo complained of sexual side effects. Is PSP-FTF a placebo effect? Some think so. On the other hand, several experts in the field of sexual medicine are convinced that these cases represent a true causal connection independent of the placebo effect. They even have a theory about the underlying pathophysiologic mechanism. They propose that in susceptible patients certain genes may be turned on or off, and this may have permanent effects on neural circuits, neurotransmitters, and/or androgen metabolism.

To address this important issue, I have appointed a Task Force headed by Ed Epstein that includes Ken Washenik, Bob Bernstein, and Dow Stough. They have begun the difficult task of evaluating what is turning out to be a very complex situation. Their initial statement can be read at www.ishrs.org/articles/finasteride-announcement.htm. Over the coming weeks, they will be consulting with experts in urology and sexual function to evaluate the connection between finasteride and persistent sexual dysfunction and determine what if any changes the hair restoration specialist should make in counseling and treating patients. Furthermore, Mel Mayer has devoted a session in Anchorage to discuss this topic. This is an incredibly complex problem and we should not expect black and white answers.

This is a problem we cannot ignore. I suggest we take it seriously and evaluate it with an open mind. We should not be emotionally attached to an idea because our first duty is to our patients. Helping our patients make an informed decision should be our top priority.◆

Co-editors' Messages

Nilofer P. Farjo, MBChB *Manchester, United Kingdom* editors@ISHRS.org

A few years ago all the media wanted to report was "the new cure for baldness has arrived: cloning." Although the studies that were being conducted were cell therapy and not cloning, the basic premise was correct: finding a way in the lab to expand on the available donor hair. For a variety of reasons this "cure" for baldness has not materialized so far, and although there has been ongoing research in this field, it now seems that the latest approach is switching in favour of the new craze: "growth factors." Dr. Ralf Paus (dermatologist and hair biologist), a guest speaker at a previous ISHRS Annual Scientific Meeting, dismissed the idea of "cloning" as the answer to treating androgenetic alopecia. So perhaps his prediction was true.

Signaling compounds including growth factors are the new-age treatments in other branches of medicine such as wound healing and anti-aging medicine. In hair growth, there have been some preliminary studies looking at the use of growth factors and wnt protein stimulation in such products as platelet rich plasma. In this issue, Drs. Gary Hitzig and Jerry Cooley describe another product containing growth factors as one of its components. It will be interesting to see where these new technologies lead to in the treatment of AGA and other forms of hair loss.

While we wait for the results from clinical studies with signaling compounds, we must not lose sight of the basics and scrutinize existing techniques to analyze how we can improve these to prevent poor growth. There are a number of articles in this issue that touch on these concepts. Donor removal and graft placement tools are certainly one of these as we know that poor handling of follicles can have a deleterious affect on results. Dr. Sanjiv Vasa and others have described their approaches to this dilemma. Holding solutions is another. There is a lot of published work by hair biologists on growth of hair follicles *in vitro* and perhaps we need to take the lessons that they have learned more seriously. Professor Mike Philpott reminds us in his article of some of the more basic concepts involved in hair follicle survival and it is certainly surprising that other fields of organ transplantation have developed specific organ holding solutions with good scientific backing but we have not in hair follicle transplantation. Dr. Philpott does remind us though that the hair follicle is very "hardy" and perhaps this is why we have got away with our methodology.◆

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"What I hate are the half-truths that are the foundation of medicine." These were the words spoken to me in my first day of residency many years ago. At the time, as a newbee doc, I remember thinking to myself, "Oh, great…perhaps you had better teach me these half-truths and then we can have this conversation." As my career unfolded with the practice of medicine both as a generalist and a specialist, I became aware of the truth of the words of my mentor who eventually went on to become the dean of the medical school. I realized that the generalists had not a chance to know in sufficient detail the dozens of topics for which they were supposed to be the authority, because underneath each of those topics lay several studies that had to be scrutinized with biostatistical tools that no generalist had or has time to use.

Although this issue should be easier to the specialist, and certainly to the sub-subspecialist, specifically, the hair transplant surgeon, such does not turn out to be the case. Our field has undeniably made huge strides, especially in the past 20 years. Nevertheless, the progress has been the result of a most peculiar mix of poor study designs, of poor assessment tools such as the micrometer, of doggedly tenacious personalities, of plain old Mr. Wizard curiosity, and of self-promotion for marketing advantage. In an inexplicable way, a shifting consensus of "Truth" emerged about graft size, harvesting method, or a dozen other issues that defined which surgeon was "on the cutting edge." In addition to the poor science, this shifting consensus comes from a mysterious mix of humans: the physician, scientist, entrepreneur, and, not the least influential, the Public. Wow, and this is the culmination of 400 years of the Age of Reason and Enlightenment?

Yet, incontestably, huge strides have been made in our field! What I carry away from these ruminations is that there is no better place to follow the imperative from the sixties—to "Question Authority"—than in hair transplantation. This is not so much rebellion as it is a challenge to each of us to shoulder responsibility both in initiating fresh perspectives as well as in participating in developing the (momentary) consensus for the "Ideal Technique and Philosophy of Hair Transplantation."

This issue continues the effort to enable both consensus and fresh perspectives. It addresses issues at the frontier, ACell and the optimal storage solution. The opportunity for fresh perspective includes the handling of the FU from its harvest to its implantation. Don't we all see if we look closely enough in patient follow-up the occasional patch of miniaturized growth and foci of no growth? There are many variables that could explain this observation, but traumatic placement is a leading suspect. Several world authorities address this topic in this issue and discuss some of the tools aimed at minimizing traumatic placement. As stated, the editors' intent is to give each of us an opportunity for a fresh perspective. Who knows, perhaps out of this questioning will come once again something that is even better than a previous half-truth and our field will continue to refine its impressive progress of the past two decades.

I would like to thank the individuals who have put their efforts and time into the making of this issue. Please notice their names in the bylines. Their willingness to take on the work necessary to generate the opportunity for fresh perspectives and thoughtful consensus is an inspiration to me and, I hope, to all of us to question authority for the self-satisfaction of the quest as well as for the benefit of our specialty.◆

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1. Articles should be written with the intent of sharing scientific information with the purpose of progressing the art and science of hair restoration and benefiting patient outcomes.
2. If results are presented, the medical regimen or surgical techniques that were used to obtain the results should be disclosed in detail.
3. Articles submitted with the sole purpose of promotion or marketing will not be accepted.
4. Authors should acknowledge all funding sources that supported their work as well as any relevant corporate affiliation.
5. Trademarked names should not be used to refer to devices or techniques, when possible.
6. Although we encourage submission of articles that may only contain the author's opinion for the purpose of stimulating thought, the editors may present such articles to colleagues who are experts in the particular area in question, for the purpose of obtaining rebuttal opinions to be published alongside the original article. Occasionally, a manuscript might be sent to an external reviewer, who will judge the manuscript in a blinded fashion to make recommendations about its acceptance, further revision, or rejection.
7. Once the manuscript is accepted, it will be published as soon as possible, depending on space availability.
8. All manuscripts should be submitted to editors@ISHRS.org.
9. A completed Author Authorization and Release form—sent as a Word document (not a fax)—must accompany your submission. The form can be obtained in the Members Only section of the Society website at www.ISHRS.org.
10. All photos and figures referred to in your article should be sent as separate attachments in JPEG or TIFF format. Be sure to attach your files to the email. Do NOT embed your files in the email or in the document itself (other than to show placement within the article).
11. We CANNOT accept photos taken on cell phones.
12. Please include a contact email address to be published with your article.

Submission deadlines:
June 5 for July/August 2011 issue
August 5 for September/October 2011 issue

Notes from the Editor Emeritus

Michael L. Beehner, MD *Saratoga Springs, New York* mlbeehner@spa.net

The other day I started reading the new Unger/Shapiro textbook, and as I read Dr. Tommy Hwang's chapter on recipient site influence on grafts and Dr. Sharon Keene's comments on genetic influences, I couldn't help but think of the 51-year-old patient who came in to see me this past week. I transplanted him 16 years ago and last saw him 13 years ago. Between 1995 and 1998, I performed 6 transplant sessions totaling 2,598 grafts (10,297 hairs). There were 80 large grafts, 1,176 minigrafts, and 1,342 micrografts in that mix. His results were so good at the time that I featured him in my brochure for several years, showing the density we could achieve at that time. So when I saw him on the appointment schedule for a re-visit last week, I was excited to see him again and to see the transformation we were able to accomplish, though maybe now with a few gray hairs added in. I was shocked by what I saw (see figures). Very little of the transplanted hair was present, and I wondered what could have caused this. I, of course, questioned him as to whether there had been any significant health events, any new drugs or radiation received, etc., but none of these had occurred. So I was left to wonder: Why did hair that grew so well just a decade ago disappear from this man's head? The only scenario that made any sense to me was that I must have damaged the scalp's vascularity with the five surgeries to the extent that these transferred follicles were just hanging on for dear life and eventually succumbed. On examination, I did note that his scalp was somewhat thin with little subcutaneous tissue. Also, in those years, my techniques for limiting the depth of the sites were not what they are today. I was left once again with a sense of mystery and "not knowing" regarding the fate of the follicles I had planted.

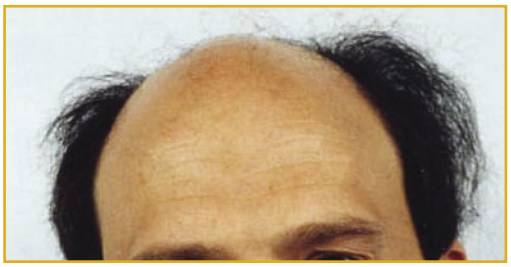

Figure 1. Before photo prior to transplants

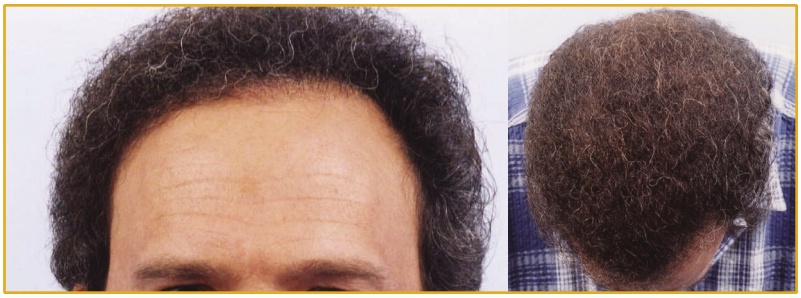

Figure 2. Hair growth after first 4 sessions

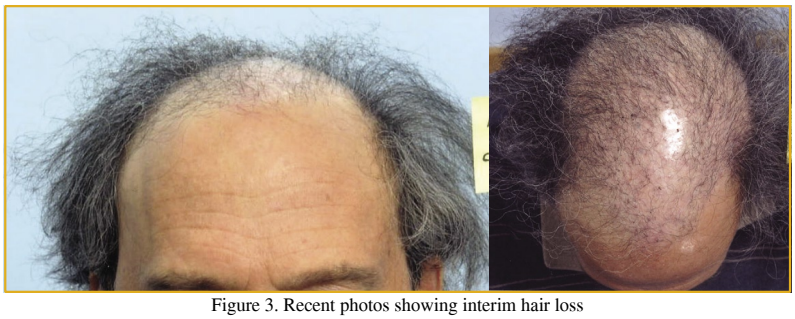

Figure 3. Recent photos showing interim hair loss

This leads me to the larger question: What do we tell prospective patients who come to us and want to make an informed decision whether or not to undergo hair transplantation? I am certain that other physicians with more than 20 years' experience have seen a great many men, and probably women, too, return to us, whose hair density had greatly diminished over the years. I am firmly convinced that for the majority of our patients *the transplanted hairs thin out at a faster rate than the other hairs in the donor area that are left untouched.* My returning patient still had dense, full, terminal hairs in his donor area. Are there recipient site influences, such as Dr. Hwang describes, at work, even though it still involves scalp hairs being moved to scalp tissue? Dr. Keene describes the strong correlation in both men and women between increased androgen receptor sensitivity and hair loss. Dr. David Whiting has proposed that some patients' terminal hairs pass in one step to oblivion, without passing through the various miniaturized steps through several hair growth cycles. Does this occur more often than we think? And what might be triggering this? Was my patient's recipient area "unfriendly" for any of these reasons? I did share this case with a few colleagues. A few recommended performing a biopsy before doing another session, and others thought it would likely be unfruitful. I offered the patient a trial of some test grafts, and am still thinking over what is best to do or to even tell him. I am certainly leaning toward doing a biopsy first.

I must confess that in my consultations I have always passed on the time-honored axiom that the transplanted hair will behave on top of the head exactly as it would have had it remained in the donor area. I believe we have to qualify that statement and state that many patients will have accelerated thinning of the transplanted hair over the years.

During my 22 years of practice, the majority of my patients have been treated with a "combination" approach using approximately 30% MFU grafts and 70% FU grafts, but I often see this same phenomenon of accelerated thinning of grafts in patients who were treated with FU grafts exclusively, both in my own patients and in those transplanted elsewhere. One interesting feature of MFU grafts I have consistently noticed over the years is that the hairs grow out earlier than do most of the FU hairs. I noticed this in the late 1980s with large grafts also.

Despite all our advances in understanding hair physiology and growth, there still seems to be this uncomfortable element of "mystery" present in what occurs in any given patient. Of course, we all put our best results on our websites and in our brochures,

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but in private conversations with other hair surgeons, we all admit to seeing cases of unexplained poor growth. There are behaviors by the follicles that we cannot explain. Do transplanted hairs look fuller a year out because they are all synchronized into the anagen phase at the same time, and then thin later as their anagen cycles randomize? Is there really a "vascular threshold" for the scalp that needs to be respected, or is it true that all but one or two of the ten scalp arteries can be cut and you'll be just fine? Probably more than a few of us have witnessed a small area of scalp necrosis or near-necrosis, so vascular compromise certainly can occur, especially just posterior to the frontal core area. How detrimental to the grafts is the drying, the handling, the skeletenizing dissection methods, the use of epinephrine in tumescence, the time out-of-body, and a whole host of other factors?

In this age of litigious medicine and people freely exposing any unhappiness all over the Internet, it becomes more important than ever for us to establish a good doctor-patient relationship of trust and open communication from the start with our patients. If we sense that someone isn't realistic or psychologically capable of accepting any result that is slightly less than he or she expects, then we would be wise to pass on being their surgeon.

A final note on what we tell our patients about graft survival: I suspect that most of us use percentages that are rosier and more optimistic than what actually occurs. My own ballpark guess is that the average "good" hair transplant clinic has an 85% yield from FU follicles and 95-100% yield with MFU grafts. As I mentioned above, I suspect there are "X factors" that each patient has, different from the next patient's, that have an enormous influence on how well the transplanted hairs will grow. Possible explanations for such factors could be autoimmune, vascular, related to scalp thickness, and possibly even to concomitant, subclinical viruses that might be circulating at the time of surgery.

Two other observations: First, whenever a study on graft survival is performed and a hair count is done at some time point out from surgery, whether it is 6, 12, 18 months, or whenever, it is probably best to describe the terminal hairs that were counted as being those hairs that are in the anagen phase at that time. This, of course, means that the other hairs present at the time of planting could be in the telogen phase, or did not survive. The length of the anagen and telogen cycles in different patients probably varies tremendously and affects these counts. My second point is that the technical ability and conscientiousness of the surgeon and his staff is an enormous factor. It is crucial that a hair transplant surgeon today have in place quality control mechanisms with accountability measurement being done on a regular basis. At our clinic, we have a drawing of the scalp with the various zones, and each assistant (and myself) sign off on an area we have filled in, so that, should that patient return a year later and had poor growth in one particular area, I can see who placed those grafts. Obviously, if there was a pattern of poor results by a certain assistant, then some feedback and instruction is in order to remedy the situation.

In closing, I would welcome some of you writing a letter to the editors to express what you see happening in your patients and if your experience is different from mine.◆

Use of porcine urinary bladder matrix

from front page

Punch Harvesting + ACell MatriStem™

In trying to approach what ACell MatriStem™ might be useful for in our field, I started by simply putting the product into punch harvest sites in the scalp. These included 1mm FUE sites as well as larger 2-5mm defects. Given the history of our field, we all have familiarity with what these sites heal like without ACell treatment. In my side-by-side studies, control areas healed as expected with a contracted circular scar that was hairless, depigmented, and fibrotic, which was palpable to the touch (Figure 1a). For punch sites treated with ACell, I created a paste by adding a small amount of sterile saline to the powder. I filled the fresh defects with this paste, and applied it daily thereafter until the sites closed up.

In ACell-treated sites, I was most focused on whether there was any conclusive evidence for de novo hair follicle neogenesis. I did not see this, and have not seen it in any of my subsequent work with this product. What I did observe was a consistent reduction or elimination of fibrotic scarring. The wounds were still depigmented, and interestingly, in small punch harvest sites with transected follicles around the edges, there was near undetectable healing and follicle ingrowth (Figure 1b). If the punch was "clean" and transection free, a soft, depigmented, hairless spot occurred at the site (Figure 1c). These studies suggested that ACell might enhance follicle regeneration after transection but did not cause hair follicles to appear out of the blue. Although regeneration of transected follicles may occur anyway, it appears that ACell makes this phenomenon more likely. This needs further study to confirm.

Strip Scars (Standard FUT Harvesting)

For these studies, I applied ACell powder or thin strips of the sheet into donor defects prior to closure. I found the powder difficult to work with, because once applied, it was hard to blot blood from the wound because the powder would also be removed. I did not see a noticeable difference whether I used powder or sheets prior to donor closure, so I have almost exclusively used small strips of the sheet (3mm wide × 7cm long). I was hoping for undetectable scars, but this is not what I saw. There was still a depigmented incisional line, and if there was tension or ischemia present, a hairless gap would result. However, there was a consistent reduction/elimination of fibrotic healing that could be determined by feeling the area, which felt normal, and comparing it to the contralateral control side (no ACell), which had a palpable fibrotic lumpiness even in well-healed scars (Figure 2). In some patients, I observed prolonged wound erythema (weeks to months) due to angiogenesis that faded over time.

My experience has been that ACell prevents the typical mild fibrosis that occurs after donor harvesting. However, in at least one case, I observed a hypertrophic scar in a patient where I had used ACell. This occurred over a month after the surgery. Given that ACell is dissolved and disappears within a couple of weeks, this is not altogether surprising. Therefore, those prone to hypertrophic or keloid scarring may well need further prophylactic treatment such as intralesional steroid injection or even follow-up injections of ACell.

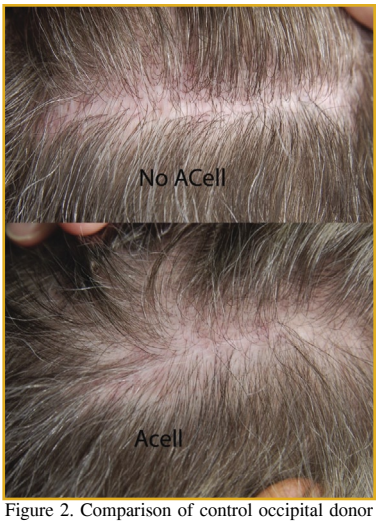

Figure 2. Comparison of control occipital donor scar (without ACell) and parietal mastoid area (with ACell); visual difference is subtle but palpation shows that ACell treated area is smooth and soft, indicating lack of fibrotic healing.

My experience with ACell in the donor area led me to conclude that there was a consistent improvement in the feel, but not necessarily the look, of donor scars. It is difficult to demonstrate this effect in photographs. Having said that, I used ACell in a couple of repair cases in which I did think the results looked better than I would have normally expected. On the other hand, I had a couple of cases early on where I falsely believed the use of ACell would be protective even though the edges were closed under great tension. The results were widened soft "hairless scars." I believe the use of ACell can make a good closure even better (by reducing fibrosis), but it will not save a closure that has tension and/or ischemia. I have now gone back on two occasions to remove strips originally treated with ACell and found that cutting through this skin is soft, unlike the hard rubbery feel I usually encounter when cutting through scar tissue.

ACell and Follicular Unit Grafting (Standard Hair Transplant)

I have been interested in graft survival since I began in this field. While microscopic dissection of follicular units produced significantly better, more consistent results, there still seems to be inexplicable patient variability. Over the years, I have become interested in the oxygenation and revascularization of the graft as the best explanation for this variability. Because ACell appears to stimulate angiogenesis, it seemed reasonable to hypothesize that its use might lead to better results from grafting.

I mixed the ACell powder (i.e., 100mg of the powder into 2cc of sterile saline) and applied a drop to a pile of grafts just prior to placing. My anecdotal observation is that the results are consistently better and more robust than without ACell, which was most notable in females with less than optimal donor areas (Figure 3). Split scalp studies are potentially difficult because ACell

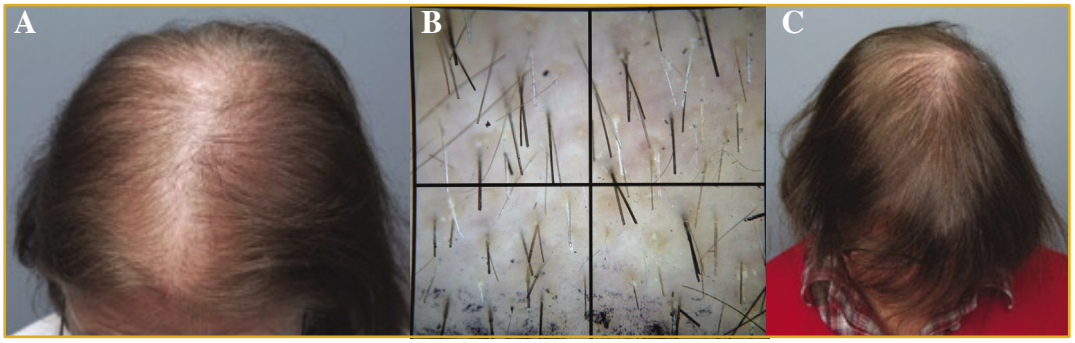

Figure 3. Clinical example of coating Acell onto follicular unit grafts in an older female patient (A) who has a suboptimal donor area (B: parietal zone) and achieves better than expected results from grafting 2,000 grafts (C).

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Use of porcine urinary bladder matrix

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treatment by its very nature (angiogenesis, stem cell recruitment) causes a field effect, not to mention that most patients do not want half their transplant turning out much better than the other half. I readily admit that these are anecdotal observations, not iron-clad proof, but my results have convinced me of a beneficial effect so I continue to use ACell on grafts.

Autocloning

Almost ten years ago, Hitzig began experimenting with using plucked beard whiskers as grafts for transplanting in those patients who had depleted their standard donor areas. He referred to this as "autocloning," given the duplication that was occurring as hair regrew at the plucked site as well as at the implantation site.[2] The success rate was low but the occasional success was very intriguing to me. After he began coating the plucked grafts with ACell, he noted a significant increase in success. I suggested that scalp hair might be preferable to beard for most patients. Prior experience with plucked scalp hair had not been successful, but after trying it with ACell, we did see success.

I then began experimenting with this procedure, plucking scalp or beard and coating the plucked graft with ACell as described above for FU grafts. The results were variable, but improved over time with greater experience. Actually handling and implanting plucked grafts is more difficult than it sounds, so this required time to gain comfort with it. I was interested in whether the hairs that grew were histologically normal so I performed biopsies in 3 of my patients. I asked our dermatopathologist, Dr. Lisa Cohen (Caris Labs, Newton, MA) to look at these. Interestingly, they were histologically completely normal and indistinguishable from normal hair follicles under H&E staining (Figure 4).

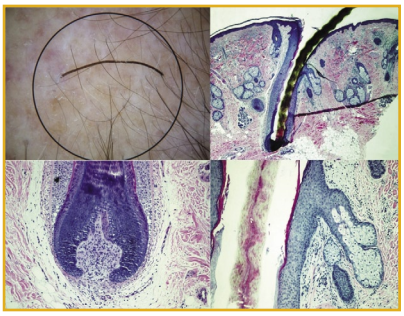

Figure 4. Photo shows a plucked beard graft coated with ACell growing 6 months after implantation (upper left); photomicrograph of same hair (upper right) shows normal microscopic anatomy with dermal papilla (lower left) and sebaceous gland (lower right).

The standard plucked graft is all epithelial tissue and contains the hair shaft, as well as inner and outer root sheath (Figure 5). How could these work as a functional graft? None of my plucked grafts produced hair in the absence of ACell but the long experience of Hitzig showed that it would sometimes occur. ACell appears to make this much more likely but the actual percentage change would require much larger controlled studies. Some have suggested that ACell-coated plucked grafts may be merely stimulating existing miniaturized follicles in the scalp. This may be occurring but does not explain two observations: 1) occasional success of plucked grafts into scar tissue, and 2) the ability to make multi-hair plucked grafts grow and subsequently observe these in areas with surrounding miniaturized hair. Creating a 4-hair graft by combining 4 plucks in a balding crown and later seeing a 4-hair graft growing at the same upright angle in which it was planted suggests that this was the graft, not a pre-existing 4-hair FU that was somehow brought back to life.

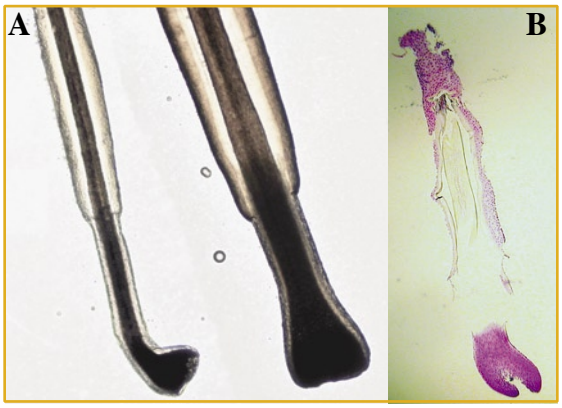

Figure 5. *A:* Photo of plucked scalp (left) and plucked beard (right); the light border around the darker hair shafts contain living epithelial cells. *B:* H&E stain of plucked graft shows hair shaft and epithelial portions of follicle attached.

The theory is that ACell coating the graft promotes implantation into the recipient bed and stimulates regeneration of the dermal papilla/dermal sheath by recruiting stem cells into the site. Where would these mesenchymal stem cells come from? Whether they come from blood/marrow, adipocytes, or nearby in the dermis or dermal sheath of adjacent follicles remains a mystery. Other unanswered questions are whether these follicles will have a normal lifespan and cycle normally. For example, they may have reduced stem cell populations and therefore be unable to cycle repeatedly over time. Finally, there is a chance these new hairs may be prone to balding if the mesenchymal layer that is regenerated is androgen sensitive. Furthermore, the occasional plucked graft also contains an attached dermal papilla, which further complicates the analysis. Some worry that after plucking grafts from the donor scalp, hair will not grow back. This has not been observed but it is a legitimate concern. All of these questions will require significant time to sort out before plucked grafts can be considered a standard treatment option.

Conclusion

My experience with Acell Matristem™ has led me to conclude that this product has diverse applications in hair restoration surgery. This is my experience only and others may come to different conclusions in their hands, especially if the manner in which ACell is used is different.

In my hands, use of ACell enhances punch and strip healing by reducing fibrotic scarring, resulting in soft pliable tissue. ACell does not save a bad closure but may make a good closure even better. ACell applied to standard FU grafts appears to result in more consistent and robust growth, perhaps through angiogenesis or some other mechanisms. Using ACell appears to facilitate follicle regeneration from implanted plucked hairs (autocloning), but there are many questions that must be answered before this technique enters the mainstream. Hopefully, these anecdotal observations will serve as a useful starting point for well-designed, controlled clinical studies.

References

1. Beattie, A.J., et al. Chemoattraction of progenitor cells by remodeling extracellular matrix scaffolds. (Report). *Tissue Engineering, Part A: Tissue Engineering.* 15.5 (May 2009): 1119(7).
2. Hitzig, G. Auto-cloning of beard hair. *Hair Transplant Forum Int'l.* 2006; 16(2):55.◆