

Nano Silver Induced Stem Cell Activation (Stem Cell Activation Therapy)

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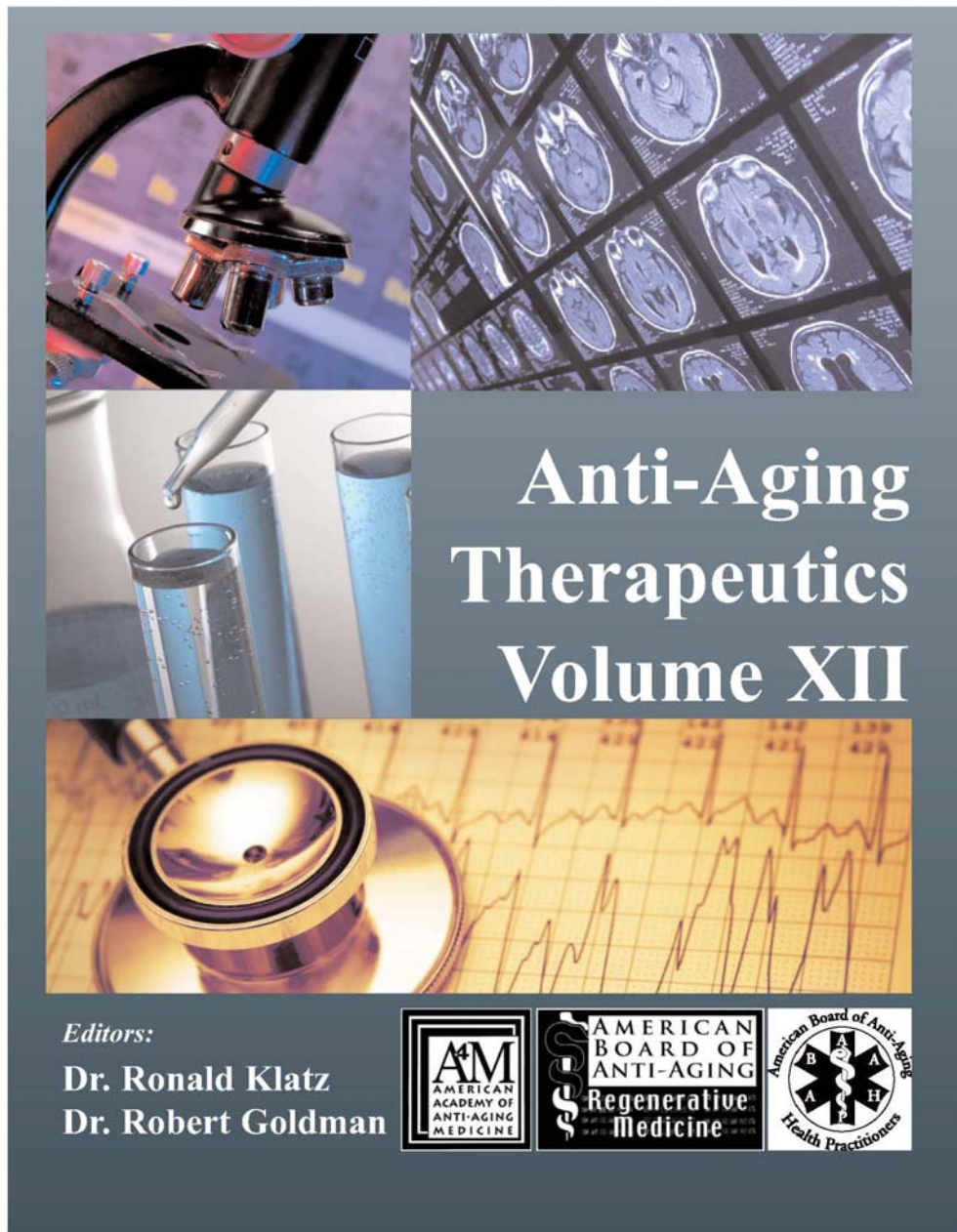
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Editors:
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NANO SILVER INDUCED STEM CELL ACTIVATION

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ABSTRACT

The importance of stem cells and stem cell regenerative medicine in healing, regenerating, rejuvenating the body; decreasing morbidity and mortality; and making the impossible possible cannot be overlooked.

Obtaining stem cells was historically restricted to the harvesting of embryonic, cord blood and adult stem cells which has made stem cell therapy an expensive, invasive, and a complicated process.

However, the technology for generating nano silver, which has the ability to activate stem cells, has progressed by leaps and bounds during the last 20 years.

This paper highlights the use of nano silver in the activation of *in vivo* stem cells¹. This has enabled stem cell therapy to be i) safe, ii) easy to derive, iii) user-friendly, iv) inexpensive, v) with no adverse effects, and vi) with no morbidity normally involved in the harvesting of stem cells.

Today, *in vivo* stem cell activation using nano silver has vastly reduced the need for costly and complicated methods of harvesting and using embryonic, cord blood, and adult stem cells². As a result, this has brought the common man closer to the benefits of stem cell regenerative medicine at a very reasonable and affordable cost. Once the exclusive domain of high cost medical treatment, *in vivo* stem cell activation has made available stem cell therapy to the masses in a large number of day to day situations as well.

Topical use of nano silver stem cell activators finds application in the treatment of burns, non-healing wounds, ulcers, and impending gangrene thereby greatly reducing the risk of amputation of diabetic foot. Stem cell activation also helps to reduce post-surgical infections, surgical scars, and wound dehiscence to negligible levels which were previously unimaginable. Another topical application of great interest is epitomized in the case of “**Fingertip Regrowth After Amputation**”.

Nano silver stem cell activators can be dispersed into body fat, bone marrow, and cerebrospinal fluid to cause accelerated healing and regeneration. Applications of this technology are numerous and include but are not limited to facial and breast reconstructive surgeries or augmentation; spinal and brain injuries; bone marrow stem cell transplant; kidney, cardiac, pancreas repair and regenerations; non-healing fractures and osteomyelitis.

Case studies are presented in this paper with a series of before and after photos, progressively taken over a period of time, to demonstrate the vast and incredible capabilities of this stem cell activation therapy. Of great interest is the case study of “**Fingertip Regrowth After Amputation**” where the entire fingertip (including the fingernail and fingerprint) have been recreated in only 30 days, compared to the previous documented case using silver in 1995, which took a whole 90 days^{3,10}. Such an efficient and rapid regeneration is unprecedented. A fingernail in the human body normally grows at a steady pace which requires 5 to 6 months to replace its entire length⁸. In this case however, the entire length is regenerated in only a 30 days period. *This demonstrates the approximately five-fold accelerated healing and regeneration capabilities of nano silver stem cell activation as compared to unaided healing of the body.*²

SUMMARY

In vivo nano silver stem cell activation not only helps to dedifferentiate mature cells but also helps to provide larger number of progenitor cells from existing stem cells, including those obtained through dedifferentiation, ensuring highly accelerated healing and regeneration. This will reduce the dependence on the harvesting of embryonic, cord blood, and adult stem cells. Thus, the benefits of stem cell regenerative medicine will enable the common man to pursue this line of treatment at a very reasonable and affordable cost.

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KEYWORDS: stem cells, bone marrow, brain injuries, spinal injuries, bone marrow stem cell transplant, regenerative medicine, stem cell harvesting, dedifferentiation of stem cells, stem cell activation, progenitor cells, fat transplant, fat aspirate and transplant, fat grafting, breast reconstructive surgery, breast augmentation, facial reconstructive surgery, spinal injuries, brain injuries, melasma, derma rolling, stem cell gel, anti-aging medicine.

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INTRODUCTION

The importance of stem cells and stem cell regenerative medicine in healing, regenerating, rejuvenating the body; decreasing morbidity and mortality; and making the impossible possible cannot be overlooked.

Obtaining stem cells was historically restricted to the harvesting of embryonic, cord blood and adult stem cells which has made stem cell therapy an expensive, invasive, and a complicated process.

However, the technology for generating nano silver, which has the ability to activate stem cells, has progressed by leaps and bounds during the last 20 years.

This paper highlights the use of nano silver in the activation of *in vivo* stem cells¹. This has enabled stem cell therapy to be i) safe, ii) easy to derive, iii) user-friendly, iv) inexpensive, v) with no adverse effects, and vi) with no morbidity normally involved in the harvesting of stem cells.

Today, stem cell activation using nano silver has vastly reduced the need for costly and complicated methods of harvesting and using embryonic, cord blood, and adult stem cells². As a result, this has brought the common man closer to the benefits of stem cell regenerative medicine at a very reasonable and affordable cost. Once the exclusive domain of high cost medical treatment, *in vivo* stem cell activation has made available stem cell therapy to the masses in a large number of day to day situations as well.

Nano silver stem cell activators can be applied topically or can be dispersed into body fat, bone marrow, and cerebrospinal fluid to cause accelerated healing and regeneration. Applications of this technology are numerous and include but are not limited to facial and breast reconstructive surgeries or augmentation; spinal or brain injuries; bone marrow stem cell transplant; kidney, cardiac, pancreas repair and regenerations; non-healing fractures and osteomyelitis.

TOPICAL APPLICATION OF NANO SILVER STEM CELL ACTIVATION

The local antibiotic effect of silver nano particles has been well established for over four decades^{4,5}. The topical application of nano silver stem cell activators will help to prevent post-surgical infections, dehiscence and hypertrophic scar formation. Daily application of topical nano silver has the potential to produce accelerated epithelialization and repair. In addition, topical application of nano silver will also help to maintain high surface concentrations of nano silver for transdermal delivery to the area under consideration for enhanced stem cell activation on an ongoing basis.

Topical application of nano silver stem cell activators finds application in the treatment of burns, non-healing wounds, ulcers, impending gangrene, and also helps to greatly reduce the risk of amputation of diabetic foot. Nano silver induced stem cell activation also helps to reduce post-surgical infections, improve scar healing, and reduce wound dehiscence to negligible levels which were previously unimaginable.

Exudates appear in open wounds during the first few days. In the presence of silver, the exudates are clean and free of germs. These exudates result in a fresh daily supply of stem cells. The exudates are a rich source of

stem cells which contribute to the accelerated healing and regenerative processes in the body. In the presence of nano silver, these stem cells will produce an ample supply of progenitor cells^{2, 10}.

Topical application of nano silver stem cell activators can also be used as a post-treatment follow-up procedure to fat grafting for breast reconstructive surgeries and breast augmentation.

Case studies are presented in this paper, with a series of before and after photos, progressively taken over a period of time, to demonstrate the vast and incredible capabilities of topical stem cell activation therapy.

Case Study 1 – Non-healing Ulcer due to Corn Excision on Heel Treated with Nano Silver Induced Stem Cell Activation Therapy

A 22 year old female nurse suffered a full thickness skin loss wound measuring 1.5 in. X 1.5 in. (3.5 cm X 3.5 cm) when treated for the removal of corn on the medial aspect of her foot. She was referred to a plastic surgeon for skin grafting because the wound did not show any signs of healing during the first seven days.

She was treated with nano silver stem cell activators which were topically applied for a period of two weeks. Being a nurse in the operating room, she was weight bearing throughout the period of this treatment. The wound epithelialized in two weeks without any adverse reaction or effects.

Epithelialization of the wound with normal skin cover occurred in seven weeks.

Such a recovery is remarkable considering this was a full thickness skin loss on a difficult area (weight bearing area of the sole), it is important to note that in the present case study, the wound healed without skin replacement (skin grafting) and without any immobilization which is normally found necessary for healing.

Conventionally, the healing granulation tissue growth in open wounds begins at the periphery and proceeds towards the center.² However, with the topical application of nano silver stem cell activators, simultaneous and complete coverage of the entire wound (a lawn of granulation tissue) was observed much earlier.

The growth rates of granulation tissue were approximately five times faster with nano silver induced stem cell activation than without².



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01/08/2010

**Non-healing Ulcer due to Corn Excision on Heel Treated with
Nano Silver Induced Stem Cell Activation – Case Study 1**

Courtesy: Dr. Neeta Patel, M.S., M.Ch. (Plastic)
Plastic & Reconstructive Surgeon, Member, ISAPS

Case Study 2 – Diabetic Foot / Gangrene Treated with Nano Silver Induced Stem Cell Activation Therapy

Diabetic foot ulcer is one complication which is extremely difficult to treat and cure. It goes unrecognized as a potential threat to limb and life. Once the ulcer develops, the diabetic patient has to expend considerable time, effort, and money to save the leg / foot. Left unsuccessfully treated, gangrene develops much to the dismay of the patient. The occurrence of diabetic foot ulcer is 15% of all patients with diabetes and precedes 84% of all lower leg amputations ⁷.

This case study is of a male diabetic patient, about 50 years of age, with a history of diabetes. Advanced stage of gangrene in the instep of the foot nearly precipitated in a decision to amputate the foot at an appropriate level. However, with no consent of the patient, this decision was deferred and the ulcer was treated with topical nano silver stem cell activation therapy.

The deterioration of the wound was immediately arrested and at the end of the first two weeks of topical application, it became evident that an enhancement of wound healing with abundant and healthy granulation tissue was occurring beyond that which could be attributed to just infection control.

By the fourth week the entire wound had contracted in all three dimensions resulting in rapid coverage of the exposed area.

Around the sixth week we could see rapid ingrowth of full thickness, innervated skin.

The topical application of stem cell activators helped healed the foot in a record period of eight weeks and averted a possible amputation.

This is a very low cost but very effective method of treatment with a very high rate of success and is slated to outperform other techniques such as: vacuum assisted closure (VAC), vacuum compression therapy (VCT), regenerative tissue matrix, tissue growth factors – platelet derived growth factor (PDGF), epidermal growth factor (EGF), reconstructive and corrective surgeries, and hyperbaric oxygen therapy (HBOT).



04/05/2010



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05/18/2010



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06/08/2010



06/15/2010

Diabetic Foot / Gangrene Treated with Nano Silver Induced Stem Cell Activation – Case Study 2

Courtesy: Dr. Neeta Patel, M.S., M.Ch. (Plastic)
Plastic & Reconstructive Surgeon, Member, ISAPS

Case Study 3 – Sternal Dehiscence After Three Unsuccessful Surgeries Treated with Nano Silver Induced Stem Cell Activation Therapy

The patient is a male who had undergone a coronary artery bypass graft (CABG) in September of 2009.

The sternal wound appeared to have healed but later developed a dehiscence. The dehiscence of the sternum was complete and the heart was exposed. The wound was sloughy and dirty. Attempts at cleaning the wound and treating it conventionally failed.

The case was then referred to a plastic surgeon towards the end of October 2009. The wound was then treated and cleaned with vacuum assisted closure dressing. This was followed by a surgical closure by pectoralis musculocutaneous advancement flaps. Three days post-operatively, the wound developed a dehiscence and infection causing further deterioration. The wound was re-cleaned and retreated with pectoralis musculocutaneous advancement flaps from the other side, which also partially necrosed and resulted in a bigger open wound than the original wound size. With the addition of vacuum assisted closure dressings, the wound started to improve in appearance and soakage decreased.

The patient was discharged and a non-surgical treatment of nano silver stem cell activation therapy was introduced to treat the wound as the three previous surgeries had proved unsuccessful to close this wound. Dressing was carried out twice a week. Topical treatment with nano silver stem cell activators was initiated and resulted in the contraction of the wound. The wound healed completely in about two and a half months.

What was particularly impressive was that there was no secondary infection. No drug antibiotics were needed to keep the open wound clean.



05/14/2010



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**Sternal Dehiscence After Three Unsuccessful Surgeries Treated with
Nano Silver Induced Stem Cell Activation – Case Study -3**

Courtesy: Dr. Ashish Davalbhakta, MBBS, M.S., M.Ch. (Plastic), FRCS (UK)
Aesthetic Plastic Surgeon

Case Study 4 – Non-healing Ulcers in Hansen’s Disease Patient Treated with Nano Silver Induced Stem Cell Activation Therapy

A patient suffering from Hansen’s disease, had an ulcer on the left heel and ulcers on the right heel and right lateral malleolus since the last six years.

She had lost all hope and was dressing herself at home for almost one year when a hospital ward boy (her nephew) brought her to the hospital for an examination by a plastic surgeon.

She was initially given vacuum assisted closure dressing and simultaneously put on a topical nano silver stem cell activation therapy, which assisted in the proliferation of the punch grafts.

Healing of these six year old ulcers occurred in a record period of about two and a half months.

Left Heel Ulcer



01/07/2010



02/17/2010



03/17/2010

Right Heel Ulcer



01/07/2010



03/17/2010

Right Lateral Malleolus Ulcer



01/07/2010



03/17/2010

Non-healing Ulcers (Hansen's Disease) Treated with Nano Silver Induced Stem Cell Activation – Case Study 4

Courtesy: Dr. Atul K. Shah, M.S.(ORL), M.Ch. (Plastic), LLB, MPhil (Hosp & Health Sy Mgt), PGDip in Medical Law and Ethics
Plastic & Reconstructive Surgeon

Case Study 5 – Non-healing Wound (Necrotizing Fasciitis) Treated with Nano Silver Induced Stem Cell Activation Therapy

The patient, a well educated young man was pursuing a career as a software engineer which required him to be at his desk for long hours.

He developed an acute onset of nectrotizing fasciitis end of February 2010, which resulted 15 days later (March 15, 2010) in a non-healing wound about four inches long by three inches wide with an exposed tendon.

The patient had thermoplast immobilisation from the second day of the onset of his skin lesion (end of February 2010).

The patient was treated with drug antibiotics. Initially, he was treated with cephalosporins and later switched to Ofloxacin (ofloxacillin).

The conventional route to completely excise the exposed tendon was deferred to see if the effects of integrating topical nano silver stem cell activation therapy would help to control and save the situation.

Within 2 weeks granulation tissue began to appear on the periphery and the wound began to heal.

Six weeks later the tendon was covered with a full layer of granulation tissue and the foot was well on its way to recovery.

It is important to note that this was accomplished without the conventional excision of the tendon and without using a skin graft or flap.

Four months later in August 2010, there was no relapse of the wound or infection.

This case speaks volumes about nano silver stem cell activation therapy and its awesome capabilities to rapidly treat large area and deep wounds measuring approximately 4.0 inches long X 3 inches wide.



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08/23/2010

Non-healing Wound (Necrotizing Fasciitis) Treated with Nano Silver Induced Stem Cell Activation – Case Study 5

Courtesy: Dr. Atul K. Shah, M.S. (ORL), M.Ch. (Plastic), LLB, MPhil (Hosp & Health Sy Mgt), PGDip in Medical Law and Ethics
Plastic & Reconstructive Surgeon

FINGERTIP REGROWTH POST-AMPUTATION

One of the most common childhood accidents is injury to a fingertip. The standard surgical procedure is to either suture a skin flap or if the fingertip has been retrieved, to try to attach it and hope for the best. Many times microsurgery is resorted to, to ensure the success and full functionality of the finger. However, in many cases this fails and the digit just falls off eventually. Those that do succeed, end up with either a shorter finger, a deformed / missing nail or with sensory loss of touch.

Fingertip regrowth is a true composite tissue regeneration involving regeneration of bone, cartilage, tendon, blood vessels, skin, nail, cuticle, fingerprint, and half a dozen of specialized sensory nerve endings.

Of great interest is the present case study of **“Fingertip Regrowth After Amputation.”** In this case, the entire fingernail and finger print have been recreated in only 30 days against the previous documented case in 1995, using silver which required a period of 90 days. This is accomplished entirely by a non-surgical procedure with a much higher success rate than mainstream surgical procedures.

Such an efficient and rapid regeneration is unprecedented. The closest attempt is a previous world record of 90 days^{10 – Pages 155 - 156} for full regrowth using silver, set in 1995 by the late Dr. Robert O. Becker at the State University of New York, and recorded in US Patent 5.814,094³.

A fingernail in the human body normally grows at a steady pace which requires five to six months to replace its entire length⁸. If the same length can be regenerated in only a 30 day period, it demonstrates the accelerated healing and regenerative capabilities of nano silver induced stem cell activation therapy. It also demonstrates improvements in activation techniques during the past few years which have made such incredible results a reality.

The ability of nano silver stem cell activators to dedifferentiate mature cells¹ gives us the ability to produce more stem cells and consequently more progenitor cells¹ than the body does under normal circumstances. In addition, this ability of nano silver to stimulate all pre-existing stem cells to enhance the rate of production of progenitor cells² results in an eventual regeneration of the fingertip in an unbelievably short span of time of 30 days. This is roughly five times faster than the unaided body really can achieve. ***This clearly demonstrates an approximately five-fold accelerated healing and regenerative capabilities of nano silver stem cell activation.***

The fingertip regeneration process occurs only if the wound is left uncovered by a flap of skin^{10 – Pages 156}. This is quite contradictory to the standard surgical procedure in mainstream medicine. This is a major deviation in the thinking process for present day surgeons who would prefer to react to such situations by resorting to simple stitches or microsurgical techniques.

Such cases of fingertip regrowth strongly suggest that the human body does have the ability to regenerate body parts given the right stimulus.

Future developments in application of stem cell activation could conceivably extend to making limb regrowth a reality.

Case Study 6 – Fingertip Regrowth with Nano Silver Induced Stem Cell Activation

A seven year old boy suffered fingertip injury to the right hand middle finger. The amputated piece was sutured back as a free composite graft by the general surgeon. Inspection on the fifth day showed that the fingertip was totally non-viable, but the patient was not cooperative and did not allow it to be removed. The patient was treated from the third day onwards with topical nano silver stem cell activators over the mentioned site of injury without removal of the graft.

Within two weeks of topical application of nano silver stem cell activators, the free composite graft finally fell off on its own.

Complete regrowth of the entire fingertip occurred in four weeks without any permanent deformity.



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Fingertip Regrowth Treated with Nano Silver Induced Stem Cell Activation – Case Study 6

Courtesy: Dr. Neeta Patel, M.S., M.Ch. (Plastic)
Plastic & Reconstructive Surgeon, Member, ISAPS

OTHER APPLICATIONS OF NANO SILVER INDUCED STEM CELL ACTIVATION

Integrating Stem Cell Activation into Fat Grafting

Adipose tissue has traditionally been used as it is a rich source of stem cells⁹ which can be easily harvested from the body without the complications of harvesting bone marrow stem cells. By integrating stem cell activation into fat grafting we can improve the overall performance and efficiency of stem cell therapy using adipose tissue stem cells.

The Theory

1. Stem cells travel to any point of injury in the body. Every injection point causes a point of injury in the body and the body releases stem cells which travel and collect at that point of injury. The injection site can be used to aggravate the area of injury to cause a higher concentration of the body's own stem cells at each point.
2. Injected fat cells also deliver their own supply of stem cells⁹ at each of these locations.
3. Nano silver stem cell activators dispersed in the fat prior to being injected help to dedifferentiate mature cells (in plasma mixed with the fat for instance and in the fat itself) thereby compounding the effect of stem cells in fat alone¹.
4. In addition, nano silver is known to stimulate pre-existing stem cells and those formed through dedifferentiation, resulting in the production of a larger number of progenitor cells².

The mathematics

If fat transplanted alone had say 1.0 million stem cells, then with the addition of body's stem cells due to multiple points of entry / injury you can increase concentration of stem cells to approximately 2.0 million stem cells. With the addition of nano silver activation you can further increase concentration to approximately 3.0 million highly activated stem cells through dedifferentiation of mature cells. Furthermore, due to stimulation by nano silver, the potency of these 3 million stem cells (in terms of its progenitor cell producing capacity) may be double or triple that of normal.

The effects of multiple points of entry / injury with nano silver dispersed fat will roughly create a five-fold increase in effect, substantially reducing the time period between and the frequency of repeated procedures. Fat aspirate and transplant work accomplished with nano silver induced stem cell activation will result in negligible fat / volume loss at the end of 6 weeks. This is a great improvement over the present state of art where fat grafting results in a 30 to 50 percent fat / volume loss with single or multi point fat grafting techniques.

Nano silver induced stem cell activation can result in a one time procedure for breast augmentation through fat grafting. Unlike traditional fat grafting techniques, there is no volume loss, no overnight hospital stay, and no future requirement or cost of repeat procedures. These attractive advantages will make these procedures more affordable and popular in the long run.

In summation

"Multiple points of injury will create higher concentrations of stem cells at each point where you inject the fat. Injecting 2 to 3 mL of fat per point of injury will probably create 100+ injection points of injury. At each point of injury the body will conglomerate its own internal stem cells as well. Nano silver will also help to indirectly increase the concentration of stem cells at each point by assisting to dedifferentiate mature cells. In addition, nano silver will also activate all existing stem cells at each point of injury to produce larger number of progenitor cells."

Some More Applications

Nano silver induced stem cell activators can be dispersed into plasma, bone marrow, cerebrospinal fluid, etc.

Nano silver induced stem cell activators can also be topically applied in conjunction with standard derma rolling of the skin to achieve more rapid and efficient regeneration of the skin.

Nano silver induced stem cell activators can also be used to treat skin pigmentation spots and melasma which is very difficult to treat otherwise.

Nano silver induced stem cell activators have also been used for burns, non-healing wounds, ulcers, impending gangrene, and diabetic foot.

Nano silver induced stem cell activators have also been known to reduce post-surgical infections, scars, as well as reduce the incidence of wound dehiscence.

ADVANTAGES OF NANO SILVER STEM CELL ACTIVATION IN BONE MARROW STEM CELL TRANSPLANTS

One of the problems facing people undergoing bone marrow stem cell transplant is, a lowered immunity due to the taking of immunosuppressant drugs, as well as the side effects of chemotherapy and radiation.

Silver has antibiotic properties which have been known for over one hundred years⁵. Silver boosts the immunity of people, prevents a wide range of infections, and helps to reduce the severity and duration of infections once they set in.

In this respect, the use of silver can help to improve the longevity of patients undergoing bone marrow transplants.

ADVANTAGES OF NANO SILVER STEM CELL ACTIVATION VERSUS STEM CELL HARVESTING

The antibiotic properties of silver have been known for the last over one hundred years^{4,5}.

Dedifferentiation of mature cells using silver has been reported as early as 1966^{10 (Page 142 – 143)}.

In the presence of silver, all stem cells, preexisting or those produced through dedifferentiation, ensure an abundant supply of progenitor cells².

When we depend upon the harvesting of stem cells, we automatically limit ourselves to a finite supply of stem cells that were harvested. *In vivo* stem cell activation with nano silver creates a daily supply of freshly, highly activated stem cells which are virtually an unlimited supply on a continuing basis. The effects achieved by nano silver stem cell activation therefore easily outperform the one time limited supply of harvested stem cells.

SUPPORTING TREATMENTS

A GOOD FOUNDATION FOR ALL TYPES OF STEM CELL THERAPIES

1. Detoxification and rejuvenation of the body⁶ is the first necessary step to ensure the success of all types of stem cell treatments. These procedures clean the body of toxins and bring the organs to peak performance to ensure rapid healing and repair of the body. Rejuvenation of the organs and especially of the digestive system ensures proper absorption of nutrition from the food we eat and the supplements that we take.

For more info: <http://www.space-age.com/detox.html>

2. Correction of the nutritional profile of the body at intracellular levels ensures adequate reserves of intracellular nutrition to carry out stem cell induced accelerated repairs in the body and anti-age various organs of the body. Intracellular nutrition⁶ also helps to reverse chronic diseases which may have caused the injury which necessitated stem cell repair of the body.

For more info: <http://www.space-age.com/aging.html>

Both these procedures can be used in conjunction and as pre / post treatments with stem cell therapy. This will ensure higher success rates for all types of stem cell therapies and more effective results in shorter periods of time.

For more info: <http://www.space-age.com/voraamt12spring09.pdf>

Carrying out large repairs can deplete nutritional levels in the body to the point where chronic diseases like hypertension, type 2 diabetes and hypothyroidism may begin to manifest in perfectly healthy people. It may also aggravate such symptoms in others already suffering from chronic diseases. This is very similar to pregnant women developing these kinds of symptoms in the third trimester of pregnancy when the nutrition of the mother is rapidly depleted to support the stem cell induced growth of the fetus. Nutritional support will help to prevent such post-stem cell therapy complications.

CONCLUSION

In vivo nano silver induced stem cell activation not only helps to dedifferentiate mature cells but will also provide larger number of progenitor cells from all existing stem cells, including those obtained through dedifferentiation. This will help to heal and regenerate at roughly five times the speed with which the body will respond to with harvested stem cell therapy.

This will result in reduced dependence on the harvesting and use of embryonic, cord blood and adult stem cells; bringing the common man closer to the benefits of stem cell regenerative medicine at a very reasonable and affordable cost.

The ability to produce dedifferentiation *in situ* of adult human cells has made possible a number of clinical applications which were previously unattainable.

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