Journal of
Regenerative Aesthetic Medicine

ISSUE 6
May 2026

Platelet-Derived Exosomes in Clinical Practice

The Expanding Scope of **Informed Consent**

From Myths to Molecules A Brief History of Regenerative Medicine

The Biology and Significance *of NAD+*

As part of the RAMI Regenerative Aesthetic Medicine Institute

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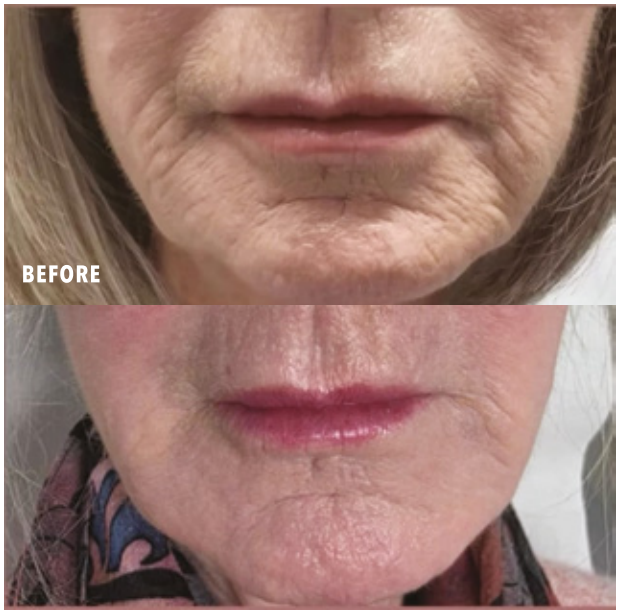

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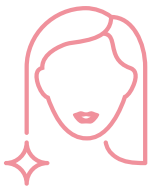

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JRAM Journal of Regenerative Aesthetic Medicine

Welcome to the Journal of Regenerative Aesthetic Medicine

This issue brings together discussions that reflect some of the most important shifts currently shaping regenerative aesthetic medicine - not only in how treatments are performed, but in how practitioners communicate, document and govern patient care. As regenerative approaches become increasingly sophisticated, the expectations surrounding informed consent are also expanding. In this issue, nurse prescriber and expert witness Jen Vittanuova explores how clinicians can approach conversations around mechanism of action, variability, timelines and evidence maturity, while RAMI's Official Insurance Partner, Hamilton Fraser examines the relationship between governance, professional protection and modern regenerative practice.

We are also excited to reveal the first draft of the RAMCE 2026 agenda on page 38. As the UK's only conference dedicated to regenerative aesthetics, RAMCE continues to bring together leading voices across science, clinical practice and technology for a day of evidence-led education and discussion. Early bird tickets are available until July 31st, and we encourage readers to secure their place at the reduced rate while availability remains.

Alongside these features, this issue includes a wide range of CPD-accredited clinical insights, scientific perspectives and educational content designed to support informed, progressive and responsible regenerative practice. We hope you enjoy reading it.

Scan now to secure your Early Bird ticket to RAMCE 2026 for just £125 +VAT!

See you on **November 7th!**

The Team

RAMI Regenerative Aesthetic Medicine Institute

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Meet our Scientific Committee

Steering the education of RAMI

Our Scientific Committee plays a crucial role in the success and credibility of The RAM Institute. Members oversee all JRAM content and curate the RAMCE programme to ensure everything we produce is cutting-edge and scientifically sound.

Professor Maurizio Cavallini

Professor Maurizio Cavallini is the Chief Medical Advisor at OU of Dermato Surgery, CDI Hospital, in Milan, Italy.. He graduated in medicine from the University of Milan, and holds postgraduate qualifications in plastic surgery, microsurgery and experimental surgery. A frequent writer and lecturer, Professor Cavallini has authored more than 130 pieces in notable national and international medical journals, as well as publishing books and speaking globally on plastic surgery and aesthetic medicine. He is also the President of the Italian Scientific Society of Aesthetic Medicine - Agora and adjunct professor in the University of Genova in Italy, along with being a fellow of many scientific societies in plastic surgery and aesthetic medicine.

Mr George Christopoulos

Mr George Christopoulos is a plastic surgeon and Assistant Professor of Aesthetic Medicine at the College of Medicine & Dentistry at Ulster University. He has a Master's in Health Care Management and a PhD (Distinction) in the surgical treatment of cancer from the University of Athens. Since relocating to the UK in 2015, Mr Christopoulos has completed a second Master's in Reconstructive Microsurgery (Distinction), and held roles in burns and plastics throughout the UK.

Dr Kate Goldie

With more than 15 years of global experience, Dr Kate Goldie is recognised as one of the leading figures in aesthetic medicine. Having trained more than 7,000 practitioners worldwide, her innovative approach and commitment to excellence have made her a sought-after educator and speaker. Beyond her extensive teaching, Dr Goldie is a respected thought leader, regularly sharing the stage with industry pioneers and contributing to groundbreaking research. Dr Goldie is deeply passionate about advancing the field of regenerative aesthetics and is at the forefront of new developments and innovations.

Dr Lee Walker

Dr Lee Walker is Director and Clinical Lead at the award-winning BCity Clinics in Liverpool, with extensive experience in medical aesthetics since 2001. He chairs the Complications in Medical Aesthetics Collaborative (CMAC) UK and has published widely on blindness, vascular occlusion, facial ageing, anatomy and injection technique. A member of the Royal College of Surgeons in both Scotland and England, he also holds postgraduate qualifications in clinical education. Dr Walker is part of Teoxane's international faculty and serves as an educational consultant for Revance USA.

Get in touch with the committee

Email **info@ram-institute.com** to discuss ideas and receive more information.

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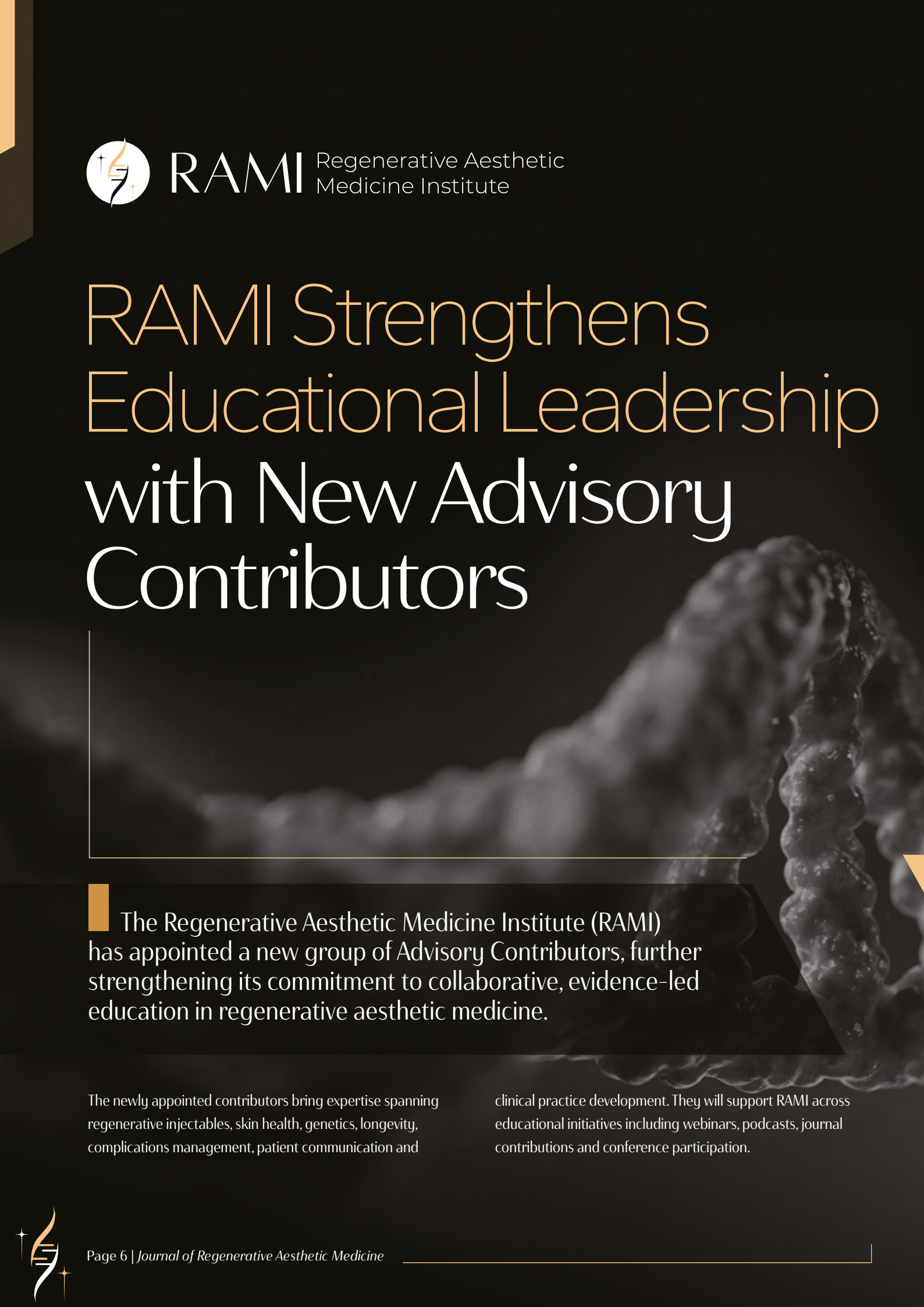
RAMI Regenerative Aesthetic Medicine Institute

RAMI Strengthens Educational Leadership with New Advisory Contributors



The Regenerative Aesthetic Medicine Institute (RAMI) has appointed a new group of Advisory Contributors, further strengthening its commitment to collaborative, evidence-led education in regenerative aesthetic medicine.

The newly appointed contributors bring expertise spanning regenerative injectables, skin health, genetics, longevity, complications management, patient communication and clinical practice development. They will support RAMI across educational initiatives including webinars, podcasts, journal contributions and conference participation.

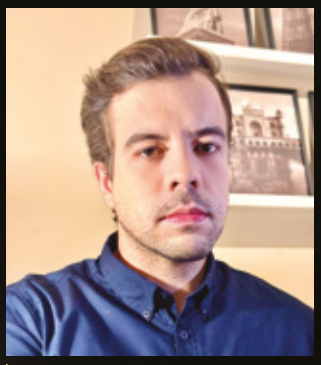
The new Advisory Contributors are:

Dr Kamran Amjed

Piril Sideras

Dr Souphi Samizadeh

Claudia McGloin



Gustavo Torres de Souza

Anna Baker

Ms Olivia McCabe-Robinson

Dr Jordan Faulkner

The appointments reflect RAMI's continued focus on bringing together multidisciplinary voices to support the evolution of regenerative aesthetics through education, discussion and shared clinical insight.

The Advisory Contributors will work alongside RAMI's Scientific Committee, which provides overall educational and scientific governance across the institute's activities. The Scientific Committee consists of Dr Lee Walker, Dr Kate Goldie, Professor Maurizio Cavallini and Mr George Christopoulos.

Scan to view full bios

Chloé Gronow, Content Director at RAMI, said: *"Regenerative aesthetics is evolving rapidly, and it's important that education reflects the diversity of perspectives shaping the field. Our Advisory Contributors bring valuable clinical, scientific and practical insight, and we're excited to work with them across webinars, editorial content, events and wider educational initiatives."*

Simon Haroutunian, Commercial Director, added, *"Building a strong educational community requires collaboration across multiple disciplines and perspectives. These appointments bring together clinicians and educators with a genuine passion for advancing regenerative aesthetic medicine responsibly and thoughtfully. We're looking forward to working with them as RAMI continues to grow its educational reach and industry partnerships."*

The new appointments come as RAMI continues to expand its educational offering, with an increasing focus on regenerative injectables, longevity, tissue health, personalised medicine and evidence-based clinical practice.

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3.HRES Gov Canada. Product Monograph Nuceiva. Last reviewed 2018. https://pdf.hres.ca/dpd_pm/00046932.PDF (Accessed 11 2023)
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5.Swiss approval letter
6.FDA APPROVAL LETTER
7.Nuceiva® SmPC

*Awarded The ACE Award for Manufacturer of the Year 2025 & 2026
*Detailed product information, batch number & certified documentation available
*Internal sales data

MARCH 2026 | GB-P-2600035

The JRAM News Brief

Essential reading on advancements in regenerative science and aesthetic practice

Market Trends, Commercial Developments and Regulation

Biostimulation Therapies Market Forecast to Reach $6.7 Billion by 2036

New market analysis suggests continued growth in biostimulation therapies, reflecting increasing global demand for regenerative and collagen-stimulating aesthetic treatments. Reports published by Fact.MR and Future Market Insights project that the global market could expand from approximately $2.6 billion in 2026 to $6.7 billion by 2036, with an estimated compound annual growth rate of around 10%.

The analyses attribute this growth to rising demand for minimally invasive procedures that support long-term skin quality and tissue regeneration, rather than immediate volumisation alone. Treatments highlighted include PLLA-based collagen stimulators, calcium hydroxyapatite biostimulators, autologous regenerative therapies and energy-based collagen induction technologies.

PLLA-based products were identified as the leading category within the market, while facial rejuvenation and skin quality improvement remain the most common treatment indications globally. The reports also highlighted increasing interest in personalised treatment planning, combination regenerative protocols and AI-supported skin assessment technologies. North America currently represents the largest market, while Asia-Pacific is forecast to experience the fastest growth over the next decade.

Polynucleotides Surpass Dermal Fillers in UK Search Trends

A five-year analysis of UK Google search behaviour by Jane Nriapia, founder of BoutiqueSEO and a Semrush Ambassador, has reported that searches for polynucleotides overtook dermal fillers in early 2024.

Using Google Trends and Semrush data between 2021 and 2026, the analysis found current UK monthly search volumes of approximately 18,100 for polynucleotides compared with around 8,100 for dermal fillers.

The report suggests the trend reflects growing public interest in regenerative aesthetic treatments associated with skin quality and collagen stimulation, rather than volumisation alone.

However, the analysis also noted that dermal fillers continue to demonstrate stronger treatment-intent searches despite increasing awareness of regenerative procedures.

The findings highlight growing consumer interest in regenerative aesthetics within the UK market, although online search behaviour does not necessarily reflect actual treatment uptake.

Company Launches Recombinant Salmon-Derived PDRN Ingredient

Manufacturer Uniproma has announced the launch of what it describes as the world's first recombinant salmon-derived polydeoxyribonucleotide (PDRN) ingredient, RJMPDRN® REC.

According to the company, the ingredient is produced using recombinant biotechnology rather than conventional extraction from salmon reproductive tissue. Uniproma states that the approach is designed to improve consistency, scalability and sustainability while reducing reliance on animal-derived sourcing.

The company also reported efficacy data suggesting enhanced regenerative activity compared with conventional salmon-derived PDRN. In vitro testing demonstrated fibroblast migration rates of 131% at 41 hours compared with controls, alongside increased collagen synthesis, with type I collagen production reported at 1.5 times and type III collagen at 1.1 times control levels.

Additional testing reportedly showed inhibition of inflammatory mediators including TNF-α and IL-6. The company further stated that combining RJMPDRN® REC with sodium hyaluronate produced synergistic effects on cell migration, suggesting potential relevance for regenerative and anti-ageing skincare formulations.

Uniproma states that the approach is designed to improve consistency, scalability and sustainability while reducing reliance on animal-derived sourcing

Merz Aesthetics Receives FDA Approval for RADIESSE in Décolleté Wrinkle Treatment

Merz Aesthetics has announced that the US Food and Drug Administration (FDA) has approved RADIESSE for the treatment of moderate to severe wrinkles in the décolleté area.

According to the company, the approval was supported by clinical data demonstrating statistically significant improvement in décolleté wrinkle appearance following treatment.

RADIESSE is a calcium hydroxylapatite-based injectable biostimulator designed to provide immediate structural support while stimulating endogenous collagen production over time. The product is already approved for facial wrinkles and volume loss indications.

The company stated that the new approval reflects increasing demand for regenerative and skin-quality-focused treatments beyond the face, particularly in areas affected by photoageing and collagen decline.

PNAS Article Calls for Stronger US FDA Oversight of Stem Cell Therapies

An article published in Proceedings of the National Academy of Sciences has argued that the US Food and Drug Administration (FDA) must continue to regulate stem cell therapies to protect patients from unsafe or unproven treatments in the United States.

The authors state that stem cell interventions in the US fall under the FDA's Human Cell, Tissue, and Cellular and Tissue-Based Product regulatory framework, but note that oversight has increasingly been challenged as commercial clinics market regenerative therapies directly to consumers.

The article highlights concerns surrounding unapproved stem cell products offered within the US market, including risks of infection, immune reactions, tumour formation and financial exploitation of vulnerable patients.

According to the authors, maintaining strong FDA oversight is essential to distinguish legitimate clinical research and approved therapies from interventions promoted without sufficient evidence of safety or efficacy.

An article has argued that the US Food and Drug Administration (FDA) must continue to regulate stem cell therapies

The paper concludes that while stem cell medicine holds significant therapeutic potential, robust regulation remains critical to supporting patient safety, scientific integrity and long-term development of evidence-based regenerative therapies in the US.

European Commission Highlights Collaborative Biotechnology Research Driving Next-Generation Therapies

The European Commission has highlighted a series of collaborative biotechnology projects it says are helping accelerate development of next-generation therapies across regenerative medicine, cell engineering and advanced biologics.

The initiatives, supported through Horizon Europe and related EU research programmes, focus on technologies including stem cell engineering, gene therapies, tissue regeneration, biomaterials and personalised medicine platforms. According to the Commission, the projects aim to strengthen translation of laboratory research into clinically applicable therapies.

The article highlights how cross-border collaboration between universities, biotechnology companies and clinical centres is being used to address challenges surrounding manufacturing, scalability, regulatory alignment and clinical integration of advanced therapies.

Areas of focus include regenerative treatments for neurodegenerative disease, tissue repair, immune modulation and rare genetic conditions, alongside development of more advanced biological delivery systems and engineered cellular therapies.

The Commission states that collaborative infrastructure and shared research networks are expected to play an increasingly important role in advancing regenerative biotechnology within Europe over the coming decade.

Study Suggests Ageing Muscle Stem Cells Prioritise Survival Over Regeneration

A study published in Science has identified a potential mechanism underlying age-related decline in muscle regeneration, suggesting that ageing muscle stem cells may prioritise long-term survival over rapid tissue repair.

Researchers compared muscle stem cells from young and aged mice and found that older cells expressed significantly higher levels of NDRG1, a tumour suppressor protein that suppresses the mTOR signalling pathway involved in cell activation and regeneration. NDRG1 levels were reported to be approximately 3.5 times higher in aged muscle stem cells.

When researchers inhibited NDRG1 activity in older mice, aged stem cells began behaving more like younger cells, activating more rapidly and accelerating muscle repair following injury. However, this effect came at a cost: long-term stem cell survival was reduced, limiting regenerative capacity after repeated injuries.

The authors describe this as a form of "cellular survivorship bias", in which stem cells better adapted to surviving the stresses of ageing gradually dominate the tissue environment, despite having reduced regenerative function.

The findings suggest that some biological changes associated with ageing may represent adaptive survival strategies rather than simple functional decline.

Researchers Investigate "Inflammaging" in Space-Based Ageing Study

Researchers from Cedars-Sinai are investigating inflammaging - the chronic low-grade inflammation associated with ageing - through experiments conducted aboard the International Space Station. The project is supported by NASA and the National Institutes of Health.

The study examines how microgravity and spaceflight accelerate biological ageing processes, allowing researchers to investigate inflammation-related cellular changes over shorter time periods than would typically occur on Earth. According to the research team, space conditions can rapidly induce alterations linked to mitochondrial dysfunction, immune dysregulation and cellular senescence.

The project focuses particularly on inflammaging, a process increasingly associated with age-related tissue decline, impaired regeneration and chronic disease. Researchers hope that understanding how inflammation accelerates ageing pathways may help identify future therapeutic targets for longevity and regenerative medicine.

The work forms part of broader efforts exploring how space-based biological research can provide insight into mechanisms of ageing, tissue repair and metabolic stress. The researchers suggest that findings may eventually contribute to development of interventions aimed at reducing inflammatory ageing processes on Earth.

Study Suggests Young Gut Microbiota Can Restore Aged Intestinal Stem Cell Function

A study published in Stem Cell Reports has reported that age-related decline in intestinal stem cell function may be partially reversible through modification of the gut microbiota.

Researchers compared intestinal stem cells (ISCs) from young and aged mice and found that ageing was associated with reduced stem cell activity, impaired intestinal regeneration and altered microbial composition within the gut.

To investigate whether these microbial changes directly

influenced regeneration, the researchers transplanted gut microbiota from young mice into aged animals. According to the study, this restored intestinal stem cell activity and improved regenerative responses following intestinal injury.

The authors also identified specific bacterial populations enriched in aged microbiota that appeared to suppress stem cell function, suggesting that microbial imbalance may contribute directly to age-related regenerative decline.

According to the authors, restoring aspects of glycocalyx function reduced inflammatory activity and improved psoriasis-like skin changes

Research Identifies Glycocalyx Changes Linked to Psoriasis Inflammation

A study published in Science Signaling has identified alterations in the glycocalyx coating surrounding immune cells as a potential contributor to psoriasis-related inflammation.

The researchers found that leukocytes develop changes in their heparan sulfate-rich glycocalyx during inflammatory responses, influencing how immune cells migrate into tissues and interact with vascular surfaces. In psoriasis models, disruption of this glycocalyx structure appeared to promote inflammatory signalling and immune-cell infiltration within the skin.

According to the authors, restoring aspects of glycocalyx function reduced inflammatory activity and improved psoriasis-like skin changes in experimental models, suggesting the glycocalyx may represent a potential therapeutic target in chronic inflammatory skin disease.

The glycocalyx is a carbohydrate-rich surface layer involved in cell signalling and mechanobiology, but its role in immune-cell behaviour has been less well understood. The findings contribute to growing evidence that extracellular surface biology plays an important role in inflammatory regulation and tissue homeostasis.

Review Highlights Shift Towards Advanced 3D Models in Skin Ageing Research

A review published in Microsystems & Nanoengineering has examined how in vitro skin models are increasingly being used to study skin ageing and evaluate regenerative and anti-ageing therapies.

The paper explores the progression from traditional two-dimensional cell cultures towards more complex systems including reconstructed human skin, 3D bioprinting, skin organoids and skin-on-chip technologies. According to the authors, these models better replicate the structure, extracellular matrix organisation and mechanical environment

of ageing human skin.

The review highlights how skin ageing is closely linked to dynamic remodelling of the extracellular matrix, including collagen degradation, elastic fibre disruption, inflammation, oxidative stress and changes in basement membrane stiffness. The authors suggest that advanced 3D systems may provide more physiologically relevant platforms for studying these processes than conventional monolayer cultures or animal models.

The paper also discusses the growing role of microphysiological systems in anti-ageing drug development and cosmetic testing, particularly following restrictions on animal testing in several regions. Technologies such as skin-on-chip platforms were highlighted for their ability to simulate mechanical stress, vascularisation and inflammatory signalling associated with ageing skin.

The authors conclude that next-generation in vitro skin models could improve understanding of skin ageing mechanisms and support development of more targeted regenerative and preventative strategies. However, they note that current systems still only partially replicate the complexity of human skin ageing in vivo.

Research Evaluates Evidence for Collagen Supplements in Skin Ageing

A review published in Aesthetic Surgery Journal Open Forum has assessed the evidence for collagen supplements in skin ageing, drawing on 16 systematic reviews from an initial pool of 573 papers.

Together, the included reviews covered 113 randomised controlled trials and 7,983 patients, providing a broad overview of the current clinical evidence base for collagen supplementation and skin health.

The authors reported that oral collagen supplements have been associated with improvements in skin hydration, elasticity and wrinkles, with some studies also suggesting positive effects on dermal density. However, they noted that findings vary across formulations, study designs and outcome measures.

The review highlights that collagen supplements differ considerably in source, dose, molecular weight, additional ingredients and duration of use, making direct comparison between products difficult.

The authors conclude that collagen supplementation may offer benefits for skin ageing, but emphasise the need for more standardised, high-quality research to clarify which formulations, dosages and treatment durations are most effective.

The authors reported that oral collagen supplements have been associated with improvements in skin hydration, elasticity and wrinkles

Exosomes, Polynucleotides and Cell Signalling

Taiwan Researchers Develop Exosome Platform Designed to Generate CAR-T Cells In Vivo

Researchers in Taiwan have announced development of what is described as the world's first exosome-based platform designed to generate CAR-T cells directly inside the body for the treatment of solid tumours.

The platform, known as EXO-101, was developed by biotechnology company Exotarget and uses engineered exosomes to deliver genetic instructions to immune cells in vivo. Rather than extracting and modifying T cells externally before reinfusion, the approach aims to programme immune cells within the patient's body.

According to the company, the technology is intended to overcome several limitations associated with conventional CAR-T therapy, including manufacturing complexity, treatment delays and reduced efficacy in solid tumours. The platform is designed to selectively target immune cells and induce expression of chimeric antigen receptors capable of recognising tumour-associated targets.

Preclinical data presented by the company reportedly demonstrated tumour suppression in animal models, alongside generation of functional CAR-T-like immune responses.

Exosomes were selected as the delivery vehicle due to their natural role in intercellular communication and their potential to transport biological cargo with lower immunogenicity than some viral delivery systems.

The announcement reflects growing interest in exosome engineering and cell-free delivery systems within regenerative medicine, oncology and translational biotechnology. However, the platform remains at a preclinical stage, and further research is needed.

Systematic Review Examines Human Evidence for Exosome-Based Skin Rejuvenation

A systematic review published in Cureus has evaluated the current human evidence surrounding exosome-based therapies for skin rejuvenation, reporting promising early findings alongside substantial limitations in the evidence base.

The review analysed human clinical studies investigating exosome therapies across indications including skin ageing, texture, pigmentation, scar improvement and post-procedural recovery. According to the authors, many studies reported improvements in skin hydration, elasticity, wrinkle appearance and overall skin quality following exosome treatment.

Several studies also suggested enhanced recovery and reduced downtime when exosomes were combined with procedures such as microneedling, fractional laser resurfacing and radiofrequency-based treatments. Reported mechanisms included modulation of inflammation, stimulation of fibroblast activity and support of extracellular matrix remodelling.

However, the review highlighted major variability across the literature, including differences in exosome source, isolation methods, delivery protocols, treatment intervals and outcome assessment. Many studies involved small patient numbers, lacked control groups or relied heavily on subjective outcome measures.

The authors conclude that exosome-based therapies show potential within regenerative aesthetics, but emphasise that current clinical evidence remains limited. They call for larger, standardised controlled trials to better establish safety, efficacy and reproducibility in skin rejuvenation applications.

Research Analyses Umbilical Cord and Adipose-Derived MSC Exosomes in Skin Regeneration

A study published in Aesthetic Surgery Journal has compared umbilical cord-derived and adipose-derived mesenchymal stem cell exosomes in a human skin ageing model.

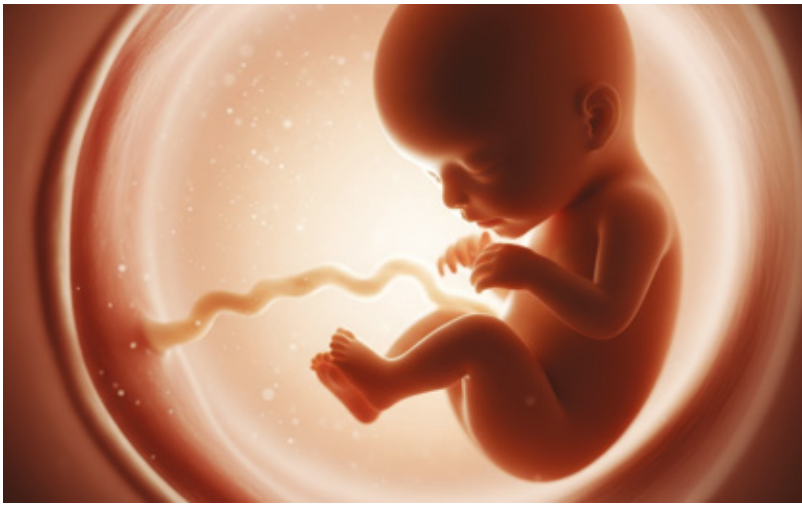
The researchers used human dermal fibroblasts and ex vivo human skin explants to assess fibroblast proliferation, cellular senescence, melanogenesis, inflammatory markers and extracellular matrix biosynthesis.

Both exosome types increased fibroblast proliferation and reduced senescence. However, adipose-derived MSC exosomes showed higher vascular endothelial growth factor content and were associated with greater collagen and hyaluronic acid production. Umbilical cord-derived MSC exosomes were enriched in transforming growth factor-beta and platelet-derived growth factor-BB, demonstrating stronger immunomodulatory activity and greater reduction of senescence-associated inflammatory markers in ultraviolet-damaged skin.

Both exosome types also reduced melanogenesis without affecting melanocyte viability, suggesting potential relevance for pigmentation-related skin ageing.

The authors conclude that the two exosome sources have distinct but complementary regenerative profiles, with adipose-derived exosomes favouring dermal matrix remodelling and hydration, while umbilical cord-derived exosomes showed stronger anti-inflammatory and photoprotective effects.

For UK clinical context, human-derived exosome products are not permitted for use.



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Study Compares Exosome and Hybrosome-Based Therapies in Regenerative Aesthetics

A narrative review published in Aesthetic Surgery Journal has compared exosome- and hybrosome-based therapies in regenerative medicine, skin ageing and aesthetic procedures.

The authors describe exosomes as nanoscale extracellular vesicles involved in intercellular communication, inflammation modulation, angiogenesis and extracellular matrix remodelling. However, they note that clinical use remains limited by challenges around stability, bioavailability, consistency and delivery.

Hybrosomes are described as engineered hybrid vesicles that combine exosomal membranes with liposomal structures. According to the review, this design may help protect bioactive cargo, improve vesicle stability and prolong regenerative activity.

The paper discusses potential relevance for skin regeneration, wound healing, skin ageing and perioperative aesthetic protocols, including pre-treatment optimisation and post-procedure recovery.

However, the authors emphasise that further long-term clinical studies and standardised production protocols are needed before hybrosome-based therapies can be considered reliable, scalable interventions in regenerative and aesthetic medicine.

Hybrosomes are described as engineered hybrid vesicles that combine exosomal membranes with liposomal structures

Study Reports Synergistic Effects of Hyaluronic Acid and Polynucleotides in UVA-Damaged Fibroblasts

A study published in Scientific Reports has investigated the combined effects of hyaluronic acid and polynucleotides on human dermal fibroblasts exposed to UVA-induced oxidative stress.

Researchers treated human dermal fibroblasts with hyaluronic acid, polynucleotides or both before exposing them to UVA radiation. UVA reduced cell viability and proliferation, increased intracellular and mitochondrial reactive oxygen species, elevated inflammatory signalling and reduced expression of extracellular matrix genes including COL1A1 and FN1.

The authors conclude that hyaluronic acid and polynucleotides may act synergistically to counter UVA-induced oxidative stress and support dermal regeneration

While hyaluronic acid and polynucleotides each partially reduced these effects, combined treatment showed a stronger synergistic response. The combination improved fibroblast survival and proliferation, reduced oxidative stress to near-baseline levels, restored extracellular matrix gene expression and increased antioxidant enzyme activity, including GPX1 and SOD2.

The combined treatment also increased fibroblast invasion, suggesting effects beyond cytoprotection and indicating potential relevance for dermal regenerative activity. Under non-irradiated conditions, neither hyaluronic acid nor polynucleotides showed cytotoxic or pro-oxidant effects at the tested concentrations.

The authors conclude that hyaluronic acid and polynucleotides may act synergistically to counter UVA-induced oxidative stress and support dermal regeneration. The findings remain laboratory-based and further studies will be required to determine clinical relevance in photoaged skin.

Study Evaluates NCTF and PDRN Injections in Skin Wound Healing

A study published in the Journal of Cosmetic Dermatology has evaluated the effects of New Cellular Treatment Factor (NCTF), polydeoxyribonucleotide (VAMP) and their combined use on full-thickness skin wound healing in a hamster model.

The study included 144 adult hamsters, randomly assigned to four groups: untreated control, NCTF injection, VAMP injection, or combined NCTF and VAMP treatment. Wounds were assessed at baseline, day three, day seven and day 14 using histological staining and CD34 immunohistochemistry to evaluate angiogenesis and capillary density.

All treatment groups showed faster wound closure, greater collagen deposition and higher microvessel density compared with controls. The combined NCTF and VAMP group produced the most pronounced improvements, followed by NCTF alone and then VAMP alone.

CD34-positive capillary density and collagen fibre alignment were significantly greater in the combination group at days seven and 14, suggesting enhanced angiogenesis and extracellular matrix organisation.

The authors conclude that both NCTF and VAMP may support early and intermediate wound healing, with combined treatment showing the strongest histological and angiogenic effects. However, the findings remain preclinical and limited to animal data over a 14-day observation period.

Wound Healing, Fibrosis and Tissue Repair

Review Explores Regenerative Strategies for Scarless Wound Healing

A review published in Advanced Science has examined emerging regenerative strategies designed to shift wound healing away from fibrosis and towards functional tissue regeneration.

The authors highlight that adult human wound healing typically prioritises rapid closure over tissue restoration, resulting in scar formation, collagen disorganisation and loss

of structures such as hair follicles and sebaceous glands. In contrast, fetal wound healing demonstrates the ability to regenerate skin with minimal fibrosis and more normal tissue architecture.

The review explores how researchers are attempting to recreate these regenerative healing environments through approaches including stem-cell-derived exosomes, secretome therapies, immunomodulation, bioactive hydrogels, growth factor delivery systems and 3D bioprinting technologies.

Particular emphasis is placed on the role of inflammatory signalling, macrophage behaviour and mechanotransduction in determining whether tissue undergoes fibrosis or regeneration following injury. According to the authors, excessive mechanical tension and dysregulated immune responses appear to be major drivers of scar formation.

The paper also notes that many current anti-scarring interventions target fibrosis after it has already developed, whereas newer regenerative approaches aim to influence healing much earlier in the repair cascade.

The authors conclude that scarless wound healing remains a major challenge in regenerative medicine, but suggest that advances in biomaterials, immune modulation and bioengineering may help support more regenerative tissue repair in the future.

Study Suggests Alpha-Ketoglutarate May Improve Stem Cell Survival in Wound Healing

Researchers have reported that alpha-ketoglutarate (AKG) may improve the survival and regenerative activity of adipose-derived stem cells in wound healing environments by supporting cellular energy balance and oxidative stress regulation.

The study investigated how AKG influences adipose-derived stem cells exposed to hypoxic, low-oxygen conditions commonly found within injured tissue. According to the researchers, AKG enhanced stem cell survival by stabilising hypoxia-inducible factor-1 alpha (HIF-1α), a key regulator of cellular adaptation to stress and oxygen deprivation.

The authors found that AKG helped maintain redox homeostasis and promoted glycogen-dependent bioenergetics, enabling stem cells to better tolerate metabolically stressful wound environments. Treated cells demonstrated improved viability, reduced oxidative damage and enhanced regenerative potential compared with untreated controls.

In wound-healing models, the enhanced stem cell survival was associated with improved tissue repair responses, suggesting that metabolic support strategies may help increase the effectiveness of regenerative cell therapies.

Study Identifies Macrophage-Derived Lactate as a Driver of Hypertrophic Scarring

A study published in Nature Communications has identified macrophage-derived lactate as a key factor driving fibroblast activation and extracellular matrix remodelling in hypertrophic scars.

The researchers found elevated lactate levels and increased expression of the lactate transporter MCT1 within hypertrophic scar tissue. Macrophages exposed to stiff mechanical environments were identified as the primary source of lactate production.

According to the study, lactate uptake by dermal fibroblasts triggered histone H3 lysine 23 lactylation (H3K23la), an epigenetic modification that promoted activation of pro-fibrotic genes linked to collagen deposition and scar progression.

The authors also identified a self-reinforcing feedback loop involving the genes HEY2 and COL11A1, which appeared to amplify fibrosis and fibroblast hyperactivation within scar tissue.

Importantly, fibroblast-specific deletion or pharmacological inhibition of MCT1 in mouse models reduced collagen deposition, accelerated wound healing and attenuated hypertrophic scar formation.

The findings contribute to growing understanding of how metabolic signalling, immune-cell activity and epigenetic regulation interact during pathological wound healing. The authors suggest the MCT1-H3K23la pathway may represent a future therapeutic target for hypertrophic scarring and fibrosis-related skin disorders.

Lab-Grown Human Skin Model Shows Microvascular Responses to Inflammation and Injury

A study published in The American Journal of Pathology has shown that human induced pluripotent stem cell-derived skin organoids can form self-organising microvascular networks that respond to inflammatory and traumatic stimuli.

Researchers found that vascular endothelial cells appeared as early as six days into the organoid differentiation process and persisted for several months. As the skin organoids matured, the developing blood vessel networks became progressively surrounded by mural cells, resembling stabilising structures seen in native human skin.

When exposed to inflammatory triggers, the organoids activated their blood vessels and surrounding tissue, expressing proteins involved in immune-cell homing and releasing additional inflammatory mediators. The researchers also demonstrated that the organoid blood vessels could regrow after sharp-object injury.

The authors note that the vascular structures showed a molecular signature resembling small arteries, but not veins or lymphatic vessels, indicating that the model remains imperfect.

The findings suggest that skin organoids could provide a useful platform for studying the role of cutaneous blood vessels in inflammation, repair, regeneration and ageing, while supporting the development of more human-relevant alternatives to animal models.

Study Introduces Automated Method for Measuring Stem Cell Migration

A study published in Optics & Laser Technology has introduced StemQuant, an automated method for quantifying mesenchymal stem cell migration in scratch assays.

Scratch assays are commonly used to assess cell migration during tissue repair research, but analysis is often manual or semi-manual, making results vulnerable to observer variation and inconsistent measurement.

The researchers developed StemQuant to automatically identify scratch boundaries and quantify migration over time, with the aim of improving reproducibility and reducing human error in stem cell experiments.

The paper is relevant to regenerative medicine because

mesenchymal stem cell migration is a key behaviour in wound healing, tissue repair and cell therapy research. More standardised analysis tools may help improve comparison between studies and strengthen the reliability of preclinical data.

The authors suggest the method could support more efficient evaluation of stem cell behaviour in regenerative and wound-healing research, although further validation across different cell types and experimental settings will be needed.

Hair Regeneration and Follicular Engineering

Study Explores Cold Plasma as a Potential Approach to Hair Regeneration

A study published in Advanced Science has reported that cold atmospheric plasma may help promote hair regeneration in mouse models by modulating the immune microenvironment surrounding hair follicles.

The researchers investigated a cold atmospheric plasma (CAP)-activated hydrogel containing interleukin-2 (IL-2) and hyaluronic acid, which was injected into the dorsal skin of depilated mice before plasma exposure triggered in situ gel formation.

Mice treated once every four days, for a total of four sessions over two weeks, demonstrated greater hair regeneration efficacy than groups treated with minoxidil or finasteride. According to the paper, mice treated with the CAPgel/IL2 system achieved 100% fur coverage within 15 days, while previously published data on daily topical 5% minoxidil reported approximately 35% fur regrowth after 14 days.

The treatment also accelerated pigmentation changes associated with transition from the telogen to anagen growth phase. Researchers observed increased expansion of regulatory T cells (Tregs) within the hair follicle microenvironment, suggesting that immune modulation played a central role in the regenerative response.

The authors propose that cold plasma may support hair regeneration by influencing inflammatory signalling, immune-cell activity and follicular repair pathways, contributing to growing interest in bioelectric and immunological approaches to tissue regeneration. Further studies will be required to determine clinical relevance in human hair loss conditions.

Cold atmospheric plasma may help promote hair regeneration in mouse models

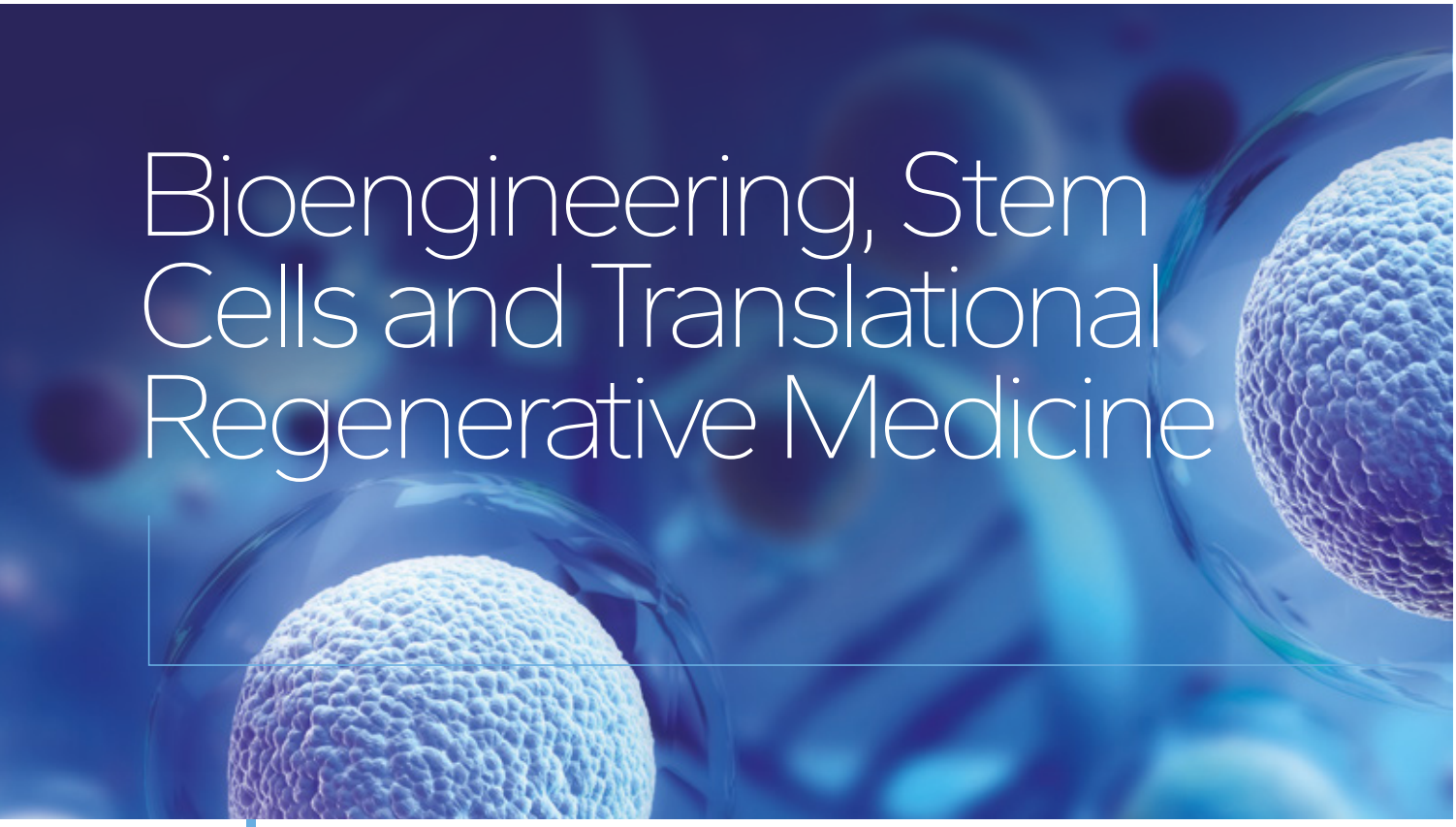
Study Reports Regeneration of Fully Functional Hair Follicles in Laboratory Models

A study published in Biochemical and Biophysical Research Communications has reported successful regeneration of fully functional hair follicles using engineered combinations of adult stem-cell-derived tissues in laboratory models.

Researchers developed a bioengineered hair follicle system by combining epithelial stem cells, dermal papilla cells and a newly identified dermal-derived mesenchymal support cell population. According to the study, inclusion of this third cell type enabled the regenerated follicles to achieve more complete structural organisation and sustained hair cycling.

When transplanted into mice, the regenerated follicles produced hair shafts that integrated with surrounding tissue and underwent repeated hair growth cycles similar to native follicles. The follicles also formed associated structures including sebaceous glands and attachment tissues important for long-term follicle function.

The authors suggest the findings address a major limitation in hair follicle bioengineering, where previous regenerated follicles often failed to maintain stable cycling or full tissue integration. Further research will be required to determine scalability, safety and translational potential in human hair loss conditions.



Japan Approves First Medical Treatments Derived From Reprogrammed Human Cells

Japan has granted conditional approval for what are reported to be the world's first medical treatments derived from induced pluripotent stem (iPS) cells, marking a major milestone in regenerative medicine.

The approvals, granted by Japan's Ministry of Health, Labour and Welfare, cover two regenerative therapies: ReHeart, developed for severe heart failure, and Amusepri, designed for Parkinson's disease. Both therapies use adult

human cells that have been reprogrammed into a stem-cell-like state capable of differentiating into specialised tissues.

ReHeart, developed by Osaka University startup Qualipse, uses sheets of cardiomyocytes derived from donor iPS cells that are surgically attached to the surface of the heart. Amusepri uses precursor dopamine-producing neurons derived from iPS cells to treat Parkinson's disease.

The approvals remain conditional and time-limited, meaning further post-marketing clinical monitoring will be required to establish long-term safety and efficacy. Researchers described the decision as a significant step towards practical application of regenerative cell therapies, while emphasising that larger-scale clinical validation is still needed.

Study Explores Combined Use of PDO Microspheres and Organic Silicon for Facial Rejuvenation

A pilot study published in Cureus has evaluated the use of polydioxanone (PDO) microspheres combined with organic silicon using a facial adipostructuring technique for facial rejuvenation.

The study included 20 patients aged 40 to 80 years who were treated with Ultra V® UltraCol 200, a liquid PDO collagen biostimulator, mixed with organic silicon. Injections were performed using the facial adipostructuring technique, a vector-based approach designed to reorganise facial adipose compartments and improve tissue support.

According to the authors, clinical evaluation demonstrated improvements in facial tridimensionality, contour definition and volumetric projection. Reductions in nasolabial fold depth and improved positioning of the malar region were also observed following treatment.

The paper discusses PDO microspheres as collagen biostimulators capable of promoting neocollagenesis through a controlled inflammatory response, while organic silicon was proposed as a potential enhancer of regenerative activity.

However, the authors note that the study was observational, involved a small cohort and lacked a control group. They conclude that larger controlled studies are required to better establish efficacy, longevity and reproducibility of the combined approach.

Clinical evaluation demonstrated improvements in facial tridimensionality, contour definition and volumetric projection

Electrohydrodynamic Bioprinting Used to Create Highly Aligned Muscle Tissue

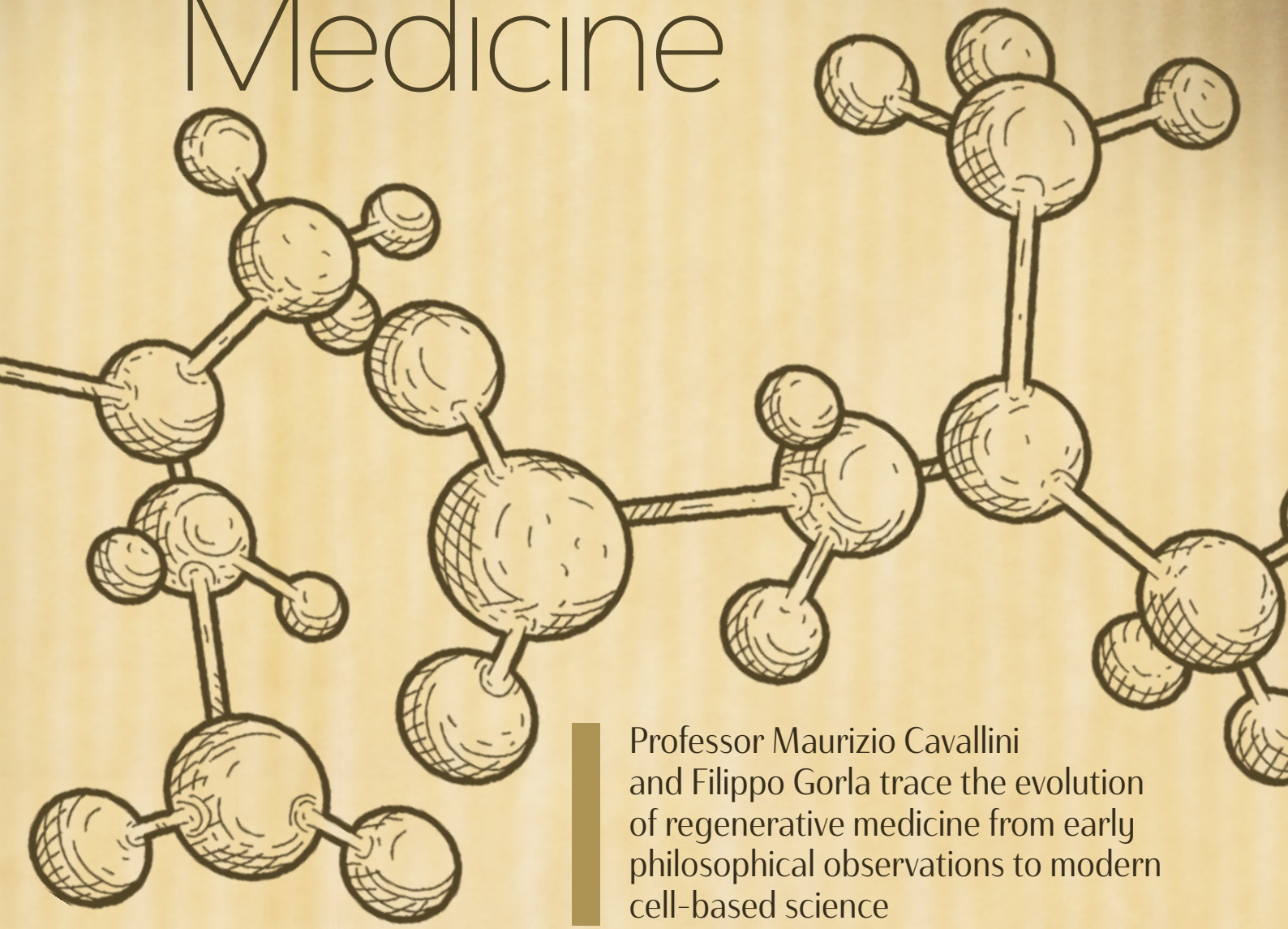
A study published in the International Journal of Extreme Manufacturing has reported the development of an electrohydrodynamic bioprinting technique capable of producing engineered muscle tissue with tightly aligned living cells, addressing a longstanding challenge in skeletal muscle tissue engineering.

The researchers used electrohydrodynamic forces to precisely deposit bioink containing living muscle cells into organised fibre structures designed to replicate the architecture of native skeletal muscle tissue. According to the study, the technique enabled significantly greater cellular alignment compared with conventional extrusion-based bioprinting approaches.

The engineered tissues also demonstrated improved maturation and contractile behaviour, both considered important indicators of functional muscle development. The authors noted that alignment is critical in skeletal muscle engineering, as natural muscle relies on highly ordered cellular organisation to generate coordinated contraction and force.

The study suggests the technology could support future development of more physiologically relevant muscle models for regenerative medicine, disease modelling and drug testing. Further research will be required to assess long-term functionality, vascular integration and clinical translation.

From Myths to Molecules: A Brief History *of* Regenerative Medicine



Professor Maurizio Cavallini and Filippo Gorla trace the evolution of regenerative medicine from early philosophical observations to modern cell-based science

Molecule image courtesy of Vecteezy.com

Throughout its long history, medicine has made continuous and significant progress. From the early observations of Greek physicians – such as Hippocrates, widely considered the father of medicine – to the discoveries of later centuries, these advances have shaped what we now recognise as modern medicine.[1]

In the late 1960s, organ transplantation represented a major therapeutic milestone. At that time, replacing a diseased organ with a healthy donor organ was considered one of the highest achievements in medicine, despite the technical challenges and the ongoing risk of immune rejection.[2]

Today, regenerative medicine has entered both diagnostic and therapeutic fields and continues to gain ground. In simple terms, it builds on the body's natural ability to repair damage, using biological elements generated by the organism itself.

Defining regenerative medicine

Regenerative medicine represents an important development in the treatment of diseases, particularly those of a degenerative nature. Degeneration should be understood not only as disease affecting organs, but also as the progressive changes associated with ageing and the natural decline of biological systems.[3]

This approach therefore goes beyond the treatment of symptoms, aiming instead to restore or regenerate tissues, cells and, in some cases, organs. To achieve this, regenerative medicine draws on advances in molecular biology and cellular science, including the study of stem cells, mononuclear cells and platelets.[4]

One of its most distinctive characteristics is the ability to stimulate processes that are already present within the body, encouraging repair through intrinsic biological mechanisms. In this sense, the organism itself becomes an active participant in the healing process.

Regeneration in myth and early thought

The idea of regenerating the human body has long existed within human imagination. In classical Greek and Roman mythology, regenerative abilities were often attributed to gods, demigods and mythical creatures.[5]

Examples include Antaeus, who was said to heal every wound on his body through contact with the earth, and the Lernaean Hydra, a venomous nine-headed aquatic serpent, capable of regrowing multiple heads when one was removed (Figure 1).[5] These narratives represent early attempts to interpret regenerative phenomena, placing them within a symbolic or supernatural framework.

The sense of awe surrounding regenerative phenomena remains evident today, even as mythological explanations have given way to scientific understanding. Over time, the fictional elements associated with these narratives have diminished, while their symbolic value has persisted. The regenerative qualities of the Hydra, for example, have been widely adopted as a metaphor: Erasmus of Rotterdam used the creature to represent the persistence of war, while counterrevolutionary movements in late 18th- and early 19th-century France employed it pejoratively to describe the Revolution's capacity to repeatedly re-emerge.[5] In this way, regeneration has come to signify not only biological renewal, but also resilience, recurrence and transformation.

Figure 1: A depiction of Lernaean Hydra, a venomous nine-headed aquatic serpent, capable of regrowing multiple heads when one was removed.

In classical Greek and Roman mythology, regenerative abilities were often attributed to gods, demigods and mythical creatures

Aristotle and the foundations of biological observations

If classical mythology confined regenerative capacity to the realm of the supernatural, it was with the philosophical and scientific reflections of Aristotle (384-322 BC) that these observations began to be brought into a more rational framework.[6] The philosopher sought to understand living systems through systematic observation, aiming to explain not only what occurs in nature, but why it occurs.

Among the most relevant works in this context is Historia Animalium, a foundational text in early zoology, in which Aristotle documented a wide range of biological phenomena (Figure 2).[6,7] Within this work, he described the ability of certain animals to regenerate lost body parts, including the regrowth of a lizard's tail. While limited by the scientific knowledge of the time, such observations represent one of the earliest attempts to interpret regeneration as a natural process rather than a supernatural event.

Figure 2: The 1619 BEIC edition of *Historia Animalium* by Aristotle (originally published c.343-340 BC).

Aristotle's broader philosophical framework proposed that the principles governing life are inherent within living matter itself, rather than imposed externally. This idea anticipates a central concept of modern regenerative medicine: that organisms possess intrinsic mechanisms capable of supporting repair and renewal.

The influence of Aristotle's naturalistic studies persisted for centuries. Even in the 16th century, zoologists such as Konrad Gessner continued to build upon Aristotelian descriptions of the natural world, further documenting regenerative phenomena in animals.[7]

While Aristotle's work cannot be considered scientific in the modern sense, he recognised a fundamental property of living systems - the capacity for regeneration - which would later become central to biological and medical research.

Early scientific observations of regeneration

The more distant history of regenerative medicine includes important contributions from 18th-century naturalists. Among them, Lazzaro Spallanzani (1729-1799), Professor of Natural History at the University of Pavia, carried out detailed experimental observations on regenerative phenomena.[8]

In his work *Dissertazioni di fisica animale e vegetabile* (1780), Spallanzani described regeneration in several species, including snails (regrowth of horns), lizards (tails) and amphibians such as frogs (limbs). Although he was unable to fully explain the biological mechanisms underlying these processes, his work demonstrated that regeneration was a reproducible natural phenomenon.

These observations were complemented by those of other 18th-century scholars, including René Antoine Réaumur and Jean-Étienne Guettard, who further documented regenerative processes in animals and contributed to the growing body of scientific knowledge in this area.[9]

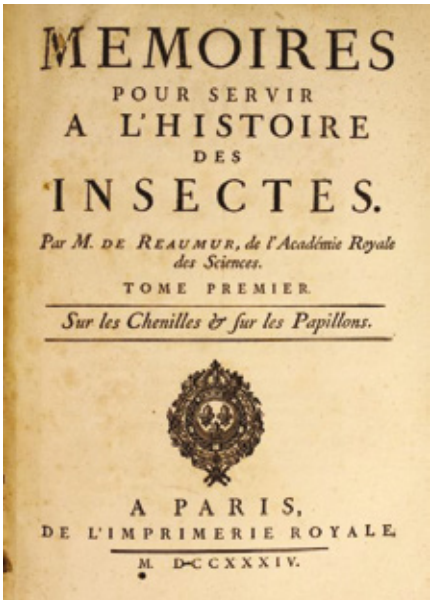


Figure 3: René-Antoine Ferchault de Réaumur's *Mémoires pour servir à l'histoire des insectes* published in 1712.

The transition to cellular understanding

It was in the 19th century that regenerative phenomena began to be more closely associated with cellular biology. Early theories proposed that cells themselves possessed regenerative potential, shifting the focus from whole organisms to their fundamental structural units.[10]

In 1892, Jacob Keller suggested that cells held intrinsic regenerative capacity. His ideas were later developed through the work of researchers such as Giulio Bizzozero (1846-1901) and Alexander Maximow (1874-1928), who contributed to the understanding of cellular lineage, particularly within the blood system.[11]

These developments ultimately led to the concept of a common origin for blood cells and laid the groundwork for later discoveries. In the mid-20th century, Alexander Friedenstein identified

mesenchymal stem cells, providing further evidence of the body's capacity for cellular regeneration.[12]

The emergence of modern regenerative medicine

The contemporary concept of regenerative medicine began to take shape in the late 20th and early 21st centuries, supported by advances in molecular biology, genetics and biotechnology.

A key milestone occurred in 2004 with the establishment of the California Institute for Regenerative Medicine, following the approval of Proposition 71 in the United States (Figure 4).[13] This initiative allocated $3 billion in public funding to support research into stem cell biology and regenerative therapies, marking one of the most significant governmental investments in the field.[13] Beyond its financial impact, the programme also played an important role in legitimising regenerative medicine as a defined area of scientific and clinical focus, accelerating both basic research and the translation of emerging therapies into clinical practice.

Today, regenerative medicine encompasses a range of approaches, including cell therapy, tissue engineering, gene therapy and the development of biomaterials and medical devices. These strategies aim not only to treat disease, but to restore structure and function by activating or supporting the body's own repair mechanisms.

Applications are being explored across multiple clinical areas, including cardiovascular, musculoskeletal, neurological and soft tissue conditions, reflecting the broad potential of this evolving field.

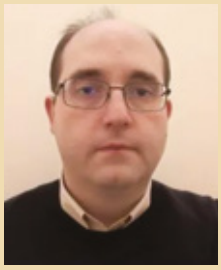
Figure 4: The Lorry I. Lokey Stem Cell Research Building at Stanford University, one of the largest California Institute for Regenerative Medicine facilities. Image copyright of Mark Tuschman.

From imagination to intervention

The concept of regeneration has evolved over time from mythological imagination to scientific reality. What was once attributed to supernatural forces is now understood as an intrinsic property of living systems, supported by increasingly sophisticated biological knowledge.

Although regenerative medicine does not eliminate ageing or disease, it represents an important shift in medical thinking - from replacement and symptom management toward restoration and biological repair. As research continues to advance, it is likely to play an increasingly central role in the future of medicine.

Professor Maurizio Cavallini is the Chief Medical Advisor at OU of Dermato Surgery, CDI Hospital, in Milan, Italy. He graduated in medicine from the University of Milan, and holds postgraduate qualifications in plastic surgery, microsurgery and experimental surgery. A frequent writer and lecturer, Professor Cavallini has authored more than 130 pieces in notable national and international medical journals, as well as publishing books and speaking globally on plastic surgery and aesthetic medicine. He is also the president of the Italian Scientific Society of Aesthetic Medicine - Agora and Adjunct Professor in the University of Geneva in Italy, along with being a fellow of many scientific societies in plastic surgery and aesthetic medicine.



Filippo Gorla completed a Ph.D in Modern and Contemporary History and Literature at the Catholic University of Milan. Since 2013, he has taught the postgraduate course in Philosophy of History and various courses in Modern History at the Faculty of Arts (now department of Human and Social Sciences of eCampus University (Como).

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Research in Focus:

Exploring a Layered Mechanical-Biological Model for Hybrid PEG-HA Fillers

A recently published study investigates whether PEG-crosslinked hyaluronic acid systems may support coordinated mechanical and biological regeneration

A proof-of-concept study published in the Journal of Applied Cosmetology by Basso et al. outlines a conceptual framework for facial rejuvenation using polyethylene glycol (PEG)-crosslinked hyaluronic acid combined with low-concentration calcium hydroxyapatite (CaHA).[1] The formulation discussed in the paper corresponds to a commercially available PEG-crosslinked HA + CaHA hydrogel.

The authors propose that this hybrid PEG-HA + CaHA system may enable immediate structural reinforcement alongside progressive tissue remodelling within a single scaffold. The paper

frames this interaction within a broader discussion of mechanobiology and physiological regeneration.

Mechanical and biological coordination

Central to the study is the concept that mechanical support and biological stimulation may occur concurrently within the same injectable matrix. The authors refer to this integrated framework as the 'Dual Core' protocol, reflecting the proposed coordination between structural reinforcement and biological activation.[1]

The PEG-crosslinked hyaluronic acid component provides immediate structural reinforcement through cohesive gel deposition, intended to restore contour and maintain localised tissue tension.[1] Unlike most conventional hyaluronic acid fillers, which are stabilised using 1,4-butanediol diglycidyl ether (BDDE), PEG crosslinking produces a chemically distinct hydrogel network. This difference in crosslinking chemistry is relevant because it influences gel architecture, cohesivity and potentially the way the material interacts with surrounding tissue.

The authors reference in vitro and histological studies suggesting that PEG-crosslinked HA may be associated with reduced macrophage recruitment and lower expression of certain pro-inflammatory cytokines when compared with traditional systems.[1]

The calcium hydroxyapatite component, present at low concentration, is proposed to stimulate fibroblast activation and collagen remodelling. Cited data include increased collagen fluorescence intensity at 21 days, together with reduced CD4+/CD8+ inflammatory-cell infiltration and normalisation of tissue architecture.[1]

Within the proposed framework, mechanical lift and biological activation are not described as separate phases but as coordinated processes occurring within the same scaffold environment, with the gel matrix providing structural stability while CaHA particles contribute to progressive extracellular matrix (ECM) remodelling.

Layered anatomical application

Beyond material composition, the study outlines a structured injection approach designed to align with facial anatomy.

The authors describe superficial or mid-fat layer placement of the PEG-HA + low-dose CaHA formulation using small micro-depots delivered via cannula.[1] This layer is intended to support dermal tension while facilitating controlled biological stimulation within the extracellular matrix. By distributing the material in limited volumes, the framework emphasises restoration of tissue integrity rather than overt augmentation.

In addition, deeper placement of a higher-elasticity PEG-crosslinked HA filler in supraperiosteal or sub-SMAS planes is described as providing structural reinforcement and supporting lifting vectors.[1] This deeper scaffold is positioned as optimising the anatomical environment for the more superficial regenerative activity.

The authors frame this two-plane strategy within a conservative-volume philosophy, advocating anatomical precision and layered support rather than high-volume correction. As presented, the technique reflects a broader shift within regenerative aesthetics toward targeted compartment-based treatment and tissue harmonisation.

A proposed metabolic dimension

In addition to mechanical support and fibroblast stimulation, the authors introduce a further conceptual element described as a potential metabolic dimension.

Drawing on emerging literature, the paper discusses the possibility that hyaluronic acid and calcium hydroxyapatite may influence communication between dermal fibroblasts and subcutaneous adipocytes.[1] This includes reference to potential modulation of exosome signalling and pathways associated with adipocyte metabolism and tissue homeostasis.

Supporting histological evidence cited within the paper includes findings from Kubik et al. (2024), who reported a 27.3% increase in collagen fluorescence intensity 21 days following treatment with PEG-HA + 1% CaHA, together with reduced CD4+/CD8+ inflammatory infiltration and normalisation of tissue architecture.[2] These observations reinforce the biological remodelling component of the framework and contribute to the broader discussion of coordinated tissue interaction.

Within this context, the metabolic dimension is presented as an extension of the mechanical-biological model, reflecting an expanding understanding of dermal-adipose communication. Further

Drawing on emerging literature, the paper discusses the possibility that hyaluronic acid and calcium hydroxyapatite may influence communication between dermal fibroblasts and subcutaneous adipocytes

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investigation will help clarify how these interactions may influence long-term tissue homeostasis.

Preliminary observations and interpretation

In preliminary clinical application of the described protocol, the authors report immediate contour improvement following treatment, with progressive enhancement in skin density and elasticity observed over a 4-6 week period.[1] No palpable nodules or significant adverse events were described within the follow-up outlined.

As presented, the framework integrates three interconnected components: mechanical reinforcement through PEG-crosslinked HA, biological stimulation via low-dose CaHA, and a proposed metabolic interaction within the dermal-adipose interface. The authors position this layered model within a broader shift in aesthetic medicine toward physiology-led regeneration and anatomically guided treatment strategies.

Future evaluation using objective imaging modalities, such as high-frequency ultrasound and three-dimensional assessment, is proposed to further characterise structural and tissue-level changes over time.

For practitioners, the paper contributes to the ongoing discussion around how chemically distinct HA systems may interact with tissue beyond volumetric correction. Whether the proposed mechanical-biological-metabolic integration translates into measurable long-term clinical advantages will continue to be explored as further data emerge.

In Practice: **Nurse Prescriber Emma Ross** on Clinical Application

While the published framework focuses on mechanistic theory and histological findings, nurse prescriber Emma Ross describes how hybrid PEG-crosslinked HA systems translate into day-to-day clinical use.

For Ross, the primary distinction lies in versatility.

"It's unlike other fillers I've used in that I can approach it from both a deep structural and a more superficial regenerative perspective," she explains. "I'm able to use it for deep structural support in patients with age-related volume changes, but also in more superficial planes where I want to encourage biostimulation alongside subtle support."

In her practice, deeper placement is typically performed as a single treatment for structural reinforcement. When used more superficially, she may adopt a short protocol approach, particularly in areas such as lateral facial lines, sometimes combining it with other treatments within a broader regenerative plan.

She views the product less as a volumising tool and more as part of a longer-term tissue strategy. "I'm thinking about tissue quality and support over time, not just replacing volume," she says. "It changes how you plan treatment."

Ross notes that patient expectations require careful management. "There is an immediate effect from the structural component, but I advise patients to allow four to six weeks for full integration and tissue response," she explains, noting, "Patients often respond positively to the concept of collagen stimulation and long-term tissue support."

From a practical perspective, she highlights the material's handling characteristics. "The extrusion force is higher than many traditional fillers, so injectors may need to adjust to that," she says. "However, slower injection can support greater control."

She also reports favourable integration in her experience. "Swelling tends to be controlled and the product integrates smoothly," she notes. "That said, it's still a dermal filler, and anatomical knowledge and careful technique remain fundamental."

Ross typically recommends annual review rather than routine retreatment, with further intervention guided by individual tissue response and ageing progression.

Disclosure: Emma Ross acts as a key opinion leader for Neauvia, the manufacturer of Neauvia Stimulate.

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RAMCE 2026

Reveals First Agenda Sessions

The Regenerative Aesthetic Medicine Conference & Exhibition (RAMCE) has revealed the first sessions confirmed for its 2026 agenda ahead of the event taking place on Saturday 7 November at the Pullman Hotel London St Pancras.

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Precision & Safety in Regenerative Practice	
Measuring Regeneration: Are We Actually Changing Tissue?	TBA
Introducing the Collagen Stimulation Ladder	Dr Jordan Faulkner
Personalised Regenerative Planning: A Clinical Classification Framework for Facial Ageing Patterns	Dr Bethany Rossington
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The Biology and Significance *of NAD+*

Dr Joshua Van der Aa explains the biological role of NAD+ in cellular energy, ageing and repair and its role in regenerative practice

Regenerative aesthetic medicine increasingly draws upon advances in cellular biology, longevity science and metabolic medicine. As understanding of the biological mechanisms that underpin ageing continues to evolve, it has become clear that many visible changes in skin quality and tissue resilience reflect deeper alterations in cellular metabolism, mitochondrial function and repair capacity.

One molecule that has attracted growing scientific interest within this context is nicotinamide adenine dinucleotide (NAD+). NAD+ is a ubiquitous coenzyme present in all living cells and plays a central role in mitochondrial energy metabolism, DNA repair and intracellular signalling pathways that regulate cellular stress responses and ageing.[1]

Declining intracellular NAD levels are now recognised as an important feature of biological ageing. Reduced NAD+ availability can impair mitochondrial efficiency, alter inflammatory signalling and limit the activity of enzymes involved in genomic maintenance and metabolic regulation.[2]

For clinicians working in regenerative aesthetics, these processes are particularly relevant. Many contemporary aesthetic interventions rely on the body's intrinsic capacity for tissue repair and remodelling. Understanding the metabolic environment in which these regenerative processes occur may therefore have increasing clinical significance.

In my own clinical practice, interest in NAD+ developed through this broader biological perspective: the recognition that cellular energy metabolism represents a fundamental determinant of tissue function, recovery and resilience.

NAD+ and cellular metabolism

NAD+ functions as a central coenzyme within cellular metabolism and plays a critical role in maintaining cellular homeostasis. Its primary biological function relates to its involvement in mitochondrial oxidative phosphorylation, where it facilitates electron transfer during cellular respiration and supports the production of adenosine triphosphate (ATP), the principal energy currency of the cell.[3]

Beyond its role in energy metabolism, NAD+ also serves as an essential substrate for several enzyme systems that regulate key biological processes, including:

- DNA repair mechanisms: NAD+ is required for the activity of poly (ADP-ribose) polymerase (PARP) enzymes involved in repairing DNA damage and maintaining genomic stability.[4]
- Epigenetic and metabolic regulation: NAD+ acts as a cofactor for sirtuin enzymes, which regulate gene expression, mitochondrial biogenesis and metabolic homeostasis. Sirtuins also promote DNA repair and genomic stability, in addition to influencing cellular stress responses and metabolic adaptation.[5]
- Cellular stress responses: NAD+ participates in signalling pathways that regulate oxidative stress, inflammatory responses and cellular adaptation to metabolic stress.[5]

Through these interconnected pathways, NAD+ plays an important role in cellular energy metabolism and repair processes. Consequently, alterations in NAD+ availability have attracted increasing attention within ageing biology and may have implications for tissues with high metabolic activity, including the skin.

NAD+ decline and ageing biology

A substantial body of research has reported reductions in intracellular NAD+ concentrations with age, with human studies demonstrating lower NAD+metabolite levels in older adults compared with younger individuals.[6] However, emerging perspectives suggest that this relationship may be more complex than initially understood. In metabolically healthy individuals, NAD+ levels may remain relatively stable over time, while reductions in NAD+ appear more closely associated with factors such as chronic inflammation, metabolic dysfunction, sleep disruption and systemic disease. As these processes become more prevalent with advancing age, the observed decline in NAD+ may reflect the cumulative impact of these stressors rather than ageing itself in isolation.

Reduced NAD+ availability has important biological consequences. Lower intracellular NAD+ concentrations can impair mitochondrial oxidative phosphorylation, reduce ATP generation and diminish the activity of NAD+–dependent enzymes involved in DNA repair and metabolic regulation.[7]

These processes contribute to several recognised features of ageing biology, including increased oxidative stress, impaired cellular repair mechanisms and altered inflammatory signalling pathways.[7]

From a physiological perspective, declining NAD+ availability may therefore influence how tissues respond to injury, stress and regenerative stimuli.

NAD+ functions as a central coenzyme within cellular metabolism and plays a critical role in maintaining cellular homeostasis

Relevance to cutaneous biology and regeneration

Although much of the NAD+ literature originates from research into systemic ageing and metabolic disease, several of the underlying mechanisms are directly relevant to cutaneous biology.

Dermal fibroblasts are metabolically active cells that require substantial mitochondrial energy production to maintain extracellular matrix synthesis and support tissue repair.[8]

Mitochondrial dysfunction has been identified as an important contributor to cutaneous ageing, influencing collagen production, oxidative stress responses and the development of cellular senescence.[9]

Experimental studies have demonstrated that reduced intracellular NAD+ availability can impair mitochondrial function and increase oxidative stress within skin cells, processes that may contribute to diminished collagen synthesis and impaired tissue repair.[10]

Conversely, restoration of NAD+ availability in experimental models has been associated with improvements in mitochondrial function and enhanced DNA repair activity following cellular stress.[7] These findings have generated increasing interest in the potential role of NAD+ metabolism in maintaining tissue resilience and regenerative capacity.

Within regenerative aesthetic medicine, where many interventions aim to stimulate endogenous repair pathways, understanding these metabolic processes may therefore have increasing clinical relevance.

Forms of NAD+ administration

Strategies aimed at influencing NAD+ metabolism can broadly be divided into approaches that support endogenous NAD+ synthesis and those that involve direct administration of NAD+ itself.

Oral supplementation strategies are widely used within longevity medicine and typically involve compounds that support endogenous NAD+ synthesis, including precursors such as nicotinamide riboside (NR), nicotinamide mononucleotide (NMN) or related metabolic cofactors.[11]

In clinical settings, intravenous administration of NAD+ is also utilised. Intravenous delivery allows NAD+ to enter the systemic circulation directly under medical supervision and has historically been explored in several medical contexts, including neurological recovery and addiction medicine. However, intravenous protocols typically require prolonged infusion times, often lasting several hours.

A further approach involves subcutaneous administration, in which smaller doses are delivered gradually. This route allows NAD+ to be introduced into the systemic circulation while avoiding the extended infusion times associated with intravenous therapy.

In my own practice, I have found subcutaneous administration to be particularly practical for patients with demanding schedules. Many individuals seeking NAD+ therapy within a longevity-focused clinical setting are professionals or athletes with limited availability for prolonged clinic-based treatments. The ability to administer smaller doses over time therefore provides a more flexible approach while still allowing NAD+ delivery through a parenteral route. For these reasons, subcutaneous administration has become my preferred method when incorporating NAD+ therapy into clinical practice.

Product purity and molecular stability

Alongside considerations regarding route of administration, the quality and stability of the NAD+ preparation itself represent important practical considerations in clinical practice. NAD+ is a chemically sensitive molecule that can degrade if manufacturing, storage or reconstitution processes are not carefully controlled.[2,3]

The molecular integrity of NAD+ is particularly relevant because its biological activity depends on the presence of the intact coenzyme structure. Degradation during production or storage can result in reduced concentrations of active NAD+ or the presence of breakdown products, which may limit the intended biological activity of the preparation.[2,3]

Before introducing NAD+ therapy into my practice, I arranged independent laboratory analysis of several commercially available NAD+ preparations. These samples were anonymised and analysed in a laboratory specialising in NAD+ chemistry in order to assess their purity.

Among the products tested, the preparation manufactured under the VIVE-NAD+ brand demonstrated the highest measured purity, with laboratory analysis indicating approximately 99.7% purity.[12]

Given the inherent instability of the molecule, ensuring the integrity of the preparation prior to administration is likely to be an important factor in maintaining the intended biological activity of NAD+. For this reason, manufacturing standards and product quality remain key considerations when incorporating NAD+ therapy into clinical practice.

Clinical experience in practice

My interest in NAD+ within clinical practice developed initially through personal exposure to the therapy, which prompted further exploration of the biological mechanisms underlying NAD+ metabolism and its potential relevance to longevity-focused medicine. Over time, I began incorporating NAD+ administration into a broader clinical framework within my practice.

In clinical use, NAD+ therapy delivered through the VIVE-NAD+ system is typically administered in small subcutaneous doses of approximately 50mg per injection. Treatment protocols often begin with a short introductory phase in which injections are administered daily for the first few days, followed by a maintenance schedule of administration every other day. In some cases, clinicians may temporarily increase dosing frequency during periods of increased physiological stress or illness.

Courses of subcutaneous NAD+ may be undertaken continuously or alternating months. Other administration schedules can be applied depending on clinical goals and practitioner guidance. As with any injectable therapy, treatment should be undertaken within recommended dosing parameters and under appropriate clinical supervision.

It is important to emphasise that the reflections described here represent observations from clinical practice rather than outcomes derived from controlled clinical trials.

Within my patient cohort, several consistent themes have emerged in patient-reported experiences following NAD+ therapy. One of the most frequently described observations relates to sleep quality, with individuals reporting deeper or more restorative sleep after beginning treatment.

Improvements in perceived cognitive clarity are also commonly reported, with some patients describing reductions in symptoms often characterised as "brain fog", a concern frequently encountered in peri-menopausal patient populations.

Some individuals additionally report improvements in perceived energy levels and resilience during periods of physical or professional demand. In addition, a number of patients presenting with inflammatory musculoskeletal complaints, including tendinopathies, have reported reductions in symptoms after initiating NAD+ therapy.

While these observations remain anecdotal and should be interpreted cautiously, they reflect patterns that have

prompted increasing clinical interest in the relationship between cellular metabolism, mitochondrial function and physiological resilience.

Future directions

Interest in NAD+ reflects a broader shift in medicine towards understanding the biological mechanisms that underpin ageing and tissue regeneration. As research in longevity science continues to expand, increasing attention is being directed towards metabolic pathways that influence cellular resilience, mitochondrial function and repair processes.

Within aesthetic medicine, this perspective is particularly relevant. Many regenerative interventions rely on the body's intrinsic capacity to repair and remodel tissue. Cellular metabolism therefore represents an important component of the biological environment in which these treatments occur.

While NAD+ has been extensively studied within the fields of ageing biology and metabolic medicine, clinical research examining its role in aesthetic or regenerative practice remains limited. Future studies will be required to determine whether modulation of NAD+ metabolism can influence treatment outcomes, tissue regeneration or recovery following aesthetic procedures.

Implications for regenerative aesthetic practice

Nicotinamide adenine dinucleotide (NAD+) occupies a central position within cellular metabolism, supporting mitochondrial energy production, DNA repair and a range of signalling pathways that influence cellular resilience. Declining NAD+ availability has been identified as a feature of biological ageing and may contribute to the metabolic changes that occur within ageing tissues.

Although the majority of current research has focused on systemic ageing and metabolic disease, the biological processes regulated by NAD+ are also directly relevant to tissue repair and regeneration. For clinicians working in regenerative aesthetics, this raises important questions about the relationship between cellular metabolism, tissue resilience and treatment outcomes.

As research into ageing biology continues to evolve, NAD+ metabolism is likely to remain an important area of investigation. Understanding how cellular energy pathways influence tissue health may ultimately provide new insights into how regenerative aesthetic treatments can be supported by broader biological optimisation.

Disclaimer: Dr Van der Aa is the Chief Medical Officer at InsideOut Biotech, the manufacturer of VIVE-NAD+.

"This article gives excellent insight into the promising research behind NAD+ as a longevity tool, but also in context of the potential benefits to the skin. While further research is clearly needed, the role of NAD+ in fibroblasts provides solid grounds for cautious optimism. Looking to the future, it will be interesting to see the results of randomised controlled trials in humans, with specific outcome measures related to skin health."

Dr Jordan Faulkner, Advisory Contributor

Dr Joshua Van der Aa is an aesthetic doctor and entrepreneur known for advanced non-surgical facial rejuvenation, with a particular focus on the eye area and natural-looking results. He is internationally renowned for his incredible results with upper eyelid filler treatments for hollow eyes, an area in which his work has attracted patients from around the world. He leads clinics in London's Harley Street and Antwerp, Belgium, where he offers a curated range of injectable, laser and regenerative treatments, and has developed an international reputation for combining technical precision with a strong aesthetic eye.

His expertise stretches beyond aesthetic medicine into longevity and lifestyle medicine. Alongside his clinical work, Dr Joshua has been closely involved in the growing field of NAD+ therapy as the Chief Medical Officer of InsideOut Biotech, the producers of VIVE-NAD+ pens. He also established Belgium's first NAD+ treatment clinic, offering both in-clinic vitamin drip treatments and at-home protocols, with a strong interest in the intersection between aesthetics, cellular health and regenerative medicine. His broader work combines online patient advocacy and product development, with an emphasis on safety, efficacy and thoughtful innovation.

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Integrating Antioxidant Assessment into Regenerative Aesthetic Treatment Planning

Nurse prescriber Nikki Zanna examines the integration of objective antioxidant assessment into clinical consultation to support personalised treatment planning and outcome optimisation

Aesthetic medicine is shifting away from predominantly corrective interventions and towards approaches that aim to support tissue regeneration and long-term structural integrity. Advances in the understanding of skin biology and extracellular matrix remodelling have contributed to the wider adoption of treatments that rely on endogenous repair mechanisms, including biostimulatory injectables, energy-based devices and controlled tissue injury techniques.[1,2]

Despite encouraging clinical outcomes, variability in treatment response remains a recognised challenge, highlighting the need for more comprehensive assessment of biological factors that influence tissue readiness and regenerative capacity.[3] Oxidative stress is a key contributor to cutaneous ageing and impaired wound healing. Reactive oxygen species (ROS) promote fibroblast dysfunction, the activation of matrix metalloproteinases and degradation of structural dermal proteins, while antioxidant defence systems are essential in maintaining redox balance and supporting tissue repair.[4,5]

Importantly, antioxidant status is influenced by modifiable factors such as dietary intake, micronutrient supplementation and lifestyle behaviours, suggesting that aspects of the cellular environment relevant to regenerative outcomes may be amenable to optimisation.[6]

This article explores the mechanistic relevance of antioxidant status in regenerative aesthetic medicine and considers how objective assessment may support treatment planning, patient preparation and response optimisation.

Reactive oxygen species (ROS) and cutaneous ageing

Oxidative stress is widely recognised as a central mechanism in both intrinsic and extrinsic skin ageing. ROS are generated through normal cellular metabolism as well as through environmental exposures, such as ultraviolet radiation, pollution and tobacco smoke.[7] Excessive ROS production disrupts cellular homeostasis, leading to damage of lipids, proteins and nucleic acids, and contributes to progressive deterioration in dermal structure and function.[8]

At the tissue level, oxidative stress has been shown to impair fibroblast proliferation and reduce the capacity for effective collagen synthesis.[9] In parallel, ROS stimulate the expression of matrix metalloproteinases, promoting degradation of collagen and elastin fibres within the extracellular matrix.[10] These processes contribute to dermal thinning, loss of tensile strength and reduced resilience of ageing skin. Oxidative damage also alters keratinocyte signalling and epidermal barrier recovery, further compromising cutaneous repair mechanisms.[11]

Antioxidant defence systems and tissue repair

Endogenous antioxidant systems, including enzymatic pathways such as superoxide dismutase and glutathione peroxidase, play a critical role in maintaining redox equilibrium.[5] Dietary antioxidants provide an additional layer of defence by neutralising free radicals and modulating inflammatory signalling pathways involved in tissue remodelling.[12]

Carotenoids in particular have demonstrated photoprotective and anti-inflammatory properties within the skin and have been associated with improved resistance to oxidative injury.[13] Adequate antioxidant availability may therefore influence key biological processes relevant to regenerative aesthetic interventions, including inflammatory regulation, fibroblast activation and extracellular matrix synthesis.[14] While these relationships are complex and influenced by multiple systemic factors, the balance between oxidative stress and antioxidant capacity represents a plausible contributor to variability in tissue healing and regenerative response.

Regenerative treatment outcomes and biological variability

Contemporary aesthetic practice incorporates treatments designed to stimulate endogenous regenerative pathways rather than provide immediate structural replacement. Biostimulatory injectables, energy-based devices and controlled tissue injury techniques aim to induce neocollagenesis, improve dermal matrix organisation and enhance overall tissue quality over time.[15,16]

These interventions depend on coordinated inflammatory signalling, fibroblast activation and extracellular matrix remodelling, processes that typically evolve over several months following treatment.[17] Although regenerative modalities have

Oxidative stress is a key contributor to cutaneous ageing and impaired wound healing

demonstrated clinical efficacy, treatment outcomes are variable. Differences in the magnitude and durability of collagen induction have been observed, reflecting the combined influence of procedural technique, treatment characteristics and individual biological variability.[3]

Determinants of treatment response

Intrinsic ageing is associated with reduced fibroblast density, diminished responsiveness to growth factors and altered inflammatory regulation, all of which may influence regenerative capacity.[18] Systemic factors, including metabolic dysfunction, chronic low-grade inflammation and environmental exposures, further affect tissue repair processes and extracellular matrix turnover.[19] Nutritional status also plays a recognised role in wound healing and collagen synthesis, with micronutrient deficiencies linked to delayed tissue recovery and impaired structural integrity.[20]

Advanced skin analysis technologies are widely used in aesthetic practice to support consultation and treatment planning. These systems can provide objective information on parameters such as hydration, pigmentation patterns, vascular features and, in some cases, indicators of dermal density or inflammation.[21]

While valuable for assessing visible and structural characteristics of skin health, they primarily reflect cutaneous presentation rather than underlying systemic influences that may affect regenerative response. Objective assessment tools capable of providing insight into broader physiological readiness for regenerative intervention remain limited in routine clinical settings. This presents a potential gap between the growing emphasis on mechanism-led treatment planning and the availability of practical measures that reflect biological factors influencing tissue repair.

Approaches such as nutritional support, metabolic conditioning and targeted lifestyle modification aim to enhance tissue resilience and healing potential

Treatment readiness and optimisation

In surgical and rehabilitative medicine, optimisation of physiological status prior to intervention is recognised as a means of improving recovery and functional outcomes.[20] Approaches such as nutritional support, metabolic conditioning and targeted lifestyle modification aim to enhance tissue resilience and healing potential.

Applying similar principles within regenerative aesthetic practice may contribute to more predictable treatment trajectories, particularly for interventions dependent on collagen remodelling and controlled inflammatory responses. Recognition of modifiable biological variables influencing tissue readiness may therefore support refinement of personalised treatment planning and long-term outcome optimisation.

Objective assessment of antioxidant status

Although oxidative stress is recognised as an important contributor to cutaneous ageing and impaired tissue repair, its evaluation in routine aesthetic consultations remains largely indirect. Clinicians frequently rely on patient-reported lifestyle factors such as dietary habits, smoking status, ultraviolet exposure and perceived stress as surrogate indicators of systemic inflammatory burden.[22]

Laboratory assessment of oxidative stress biomarkers is possible, but not routinely incorporated into aesthetic practice due to cost, accessibility and challenges in interpretation. Advances in optical technologies have enabled non-invasive estimation of antioxidant status through measurement of cutaneous carotenoid concentrations. Carotenoids are obtained exclusively from dietary sources and accumulate within the stratum corneum and subcutaneous tissue, contributing to photoprotection and modulation of oxidative processes.[13]

Spectroscopic techniques have been developed to assess carotenoid levels in the skin. Raman-based methods detect characteristic molecular vibrational signatures, whereas reflection approaches provide indirect estimation based on tissue optical properties.[23,24]

Devices utilising these principles are increasingly used in wellness and aesthetic settings to provide point-of-care insight into aspects of antioxidant status. These systems typically combine optical measurement with algorithm-based interpretation to contextualise individual results within broader population data.

One example is the Prysm iO scanner (Nu Skin), a Raman-based optical device designed for integration into preventative health and aesthetic consultations. Its AI-driven analysis is trained on a large dataset derived from over two decades of biophotonic scanning, encompassing millions of individual measurements.

Such technologies are generally intended to support patient education, facilitate discussion of modifiable

Objective assessment of antioxidant status may provide an additional dimension to aesthetic consultation

lifestyle factors and enable longitudinal monitoring, rather than to establish diagnostic thresholds or independently determine treatment eligibility.[25]

Cutaneous carotenoid measurement has been associated with dietary patterns, lifestyle behaviours and broader indicators of oxidative balance in population studies.[26] Although it does not represent a comprehensive assessment of all antioxidant pathways, objective measurement may offer a practical adjunct in evaluating biological readiness for regenerative intervention. Interpretation should remain contextual and integrated with comprehensive clinical assessment, as clinically meaningful thresholds and direct correlations with aesthetic treatment outcomes have yet to be clearly established.

Integration into regenerative aesthetic practice

Objective assessment of antioxidant status may provide an additional dimension to aesthetic consultation by supporting evaluation of biological readiness for regenerative intervention. Considered alongside established clinical tools such as detailed medical history, lifestyle assessment, visual examination and advanced skin analysis technologies, measurement of cutaneous carotenoid levels may help identify patients who could benefit from optimisation strategies prior to treatment.

Incorporating biomarker-informed discussion into consultation frameworks may also support shared decision-making and expectation management. Objective data relating to modifiable aspects of cellular health can encourage patient engagement in preparatory measures and promote a more proactive approach to treatment planning. Antioxidant status is influenced by dietary intake, micronutrient availability and lifestyle behaviours including sleep patterns, physical activity and exposure to environmental stressors.[12]

Integration of measurable biological indicators into aesthetic practice may enhance patient understanding of the relationship between systemic health and skin ageing

Where reduced antioxidant capacity is suspected, clinicians may consider a period of physiological optimisation using nutritional supplementation before initiating regenerative procedures. Although direct evidence linking antioxidant optimisation to improved aesthetic outcomes remains limited, broader medical literature supports the importance of adequate micronutrient status in wound healing, collagen synthesis and inflammatory regulation.[20]

Serial assessment of antioxidant status may provide a structured means of monitoring patient adherence to recommended lifestyle and supplementation interventions. Objective measurement can facilitate ongoing clinical dialogue and help determine whether the tissue environment is evolving in a manner supportive of regenerative change. Integration of measurable biological indicators into aesthetic practice may enhance patient understanding of the relationship between systemic health and skin ageing. This perspective aligns with increasing interest in preventative and longevity-focused care models, as well as broader trends towards self-monitoring and health optimisation.[27,28]

Safety, clinical governance and limitations

While objective assessment of antioxidant status may provide clinically useful insight into aspects of tissue biology, interpretation requires appropriate caution. Cutaneous carotenoid measurement represents an indirect indicator of redox balance and should be considered as one component within a broader clinical framework rather than a standalone determinant of treatment planning.[24]

Measurement variability may be influenced by factors including recent dietary intake, supplementation practices, skin characteristics and device-specific methodological differences.[29]

In addition, clinically meaningful threshold values that predict treatment response have not yet been clearly established. Further investigation is required to determine how changes in antioxidant status correlate with objective improvements in regenerative outcomes following aesthetic intervention.

Future directions in biomarker-guided aesthetic medicine

The developing emphasis on regenerative approaches reflects a broader shift towards integrating systemic health considerations into aesthetic treatment planning. As understanding of tissue biology continues to evolve, measurable physiological indicators such as oxidative stress, inflammatory status and metabolic health may contribute to more individualised therapeutic strategies.[28]

Advances in non-invasive diagnostic technologies and longitudinal patient monitoring are likely to further influence how clinicians evaluate and optimise regenerative outcomes. Integration of biomarker data into consultation frameworks may support development of preventative care models focused on maintaining tissue function over time rather than addressing established structural change alone.[27]

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Conclusion

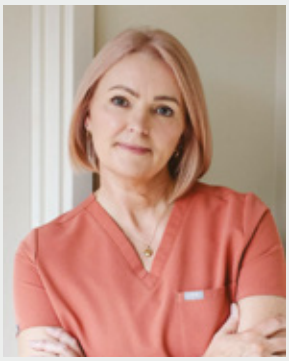
Regenerative aesthetic interventions rely on complex biological processes including inflammatory signalling, fibroblast activation and extracellular matrix remodelling. Variability in patient response highlights the importance of considering systemic influences that may affect tissue repair capacity and long-term structural outcomes.

Oxidative stress represents a biologically plausible contributor to this variability, and antioxidant defence mechanisms play a recognised role in maintaining cutaneous resilience and supporting healing pathways.[3,14] Objective assessment of antioxidant status may therefore offer a clinically relevant adjunct to mechanism-led treatment planning, supporting patient engagement in modifiable health behaviours and facilitating a shift towards preventative, longevity-focused models of care.

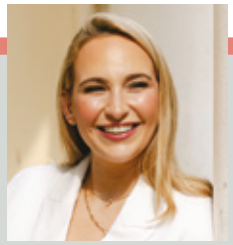
The expanding availability of non-invasive carotenoid scanning technologies such as the Raman-spectroscopy based device, Prysm iO, now being introduced into aesthetic practice, provides an opportunity to integrate measurable biological data into consultation frameworks.

While current evidence does not yet present definitive clinical thresholds or causal relationships with treatment outcomes, continued research into biomarker-guided optimisation strategies may contribute to more personalised and predictable regenerative treatment paradigms.

Disclaimer: Nikki Zanna is an affiliate of Nu Skin Enterprises, the manufacturer and distributor of Prysm iO.



Nikki Zanna is a Registered Nurse Prescriber and founder of Halo Aesthetics Cosmetic Skin Clinic, with over 15 years' experience in medical aesthetics. Her work focuses on regenerative approaches, combining advanced treatments with skincare and nutritional support. She has a particular interest in oxidative stress, longevity, and the role of new technology in supporting more personalised, preventative patient care.



"This is a strong and timely piece, particularly as the industry continues to move towards more biologically driven, regenerative approaches. The focus on oxidative stress as a contributor to variability in treatment outcomes is especially relevant and I appreciate how it introduces a more structured way of thinking about treatment readiness rather than focusing solely on the procedure itself.

The integration of antioxidant assessment into consultation is an interesting concept, particularly in supporting patient education and encouraging engagement with modifiable lifestyle factors. I also think the article does well to acknowledge the current limitations especially around the lack of clearly defined clinical thresholds and the need to interpret these tools within a broader clinical context.

The key takeaway is the importance of looking beyond the skin and considering the patient's wider biological environment when planning regenerative treatments. Even if objective antioxidant measurement isn't routinely used, the principle of optimising tissue health prior to intervention is highly valuable and aligns with a more personalised, long-term approach to care."

Piril Sideras, Advisory Contributor

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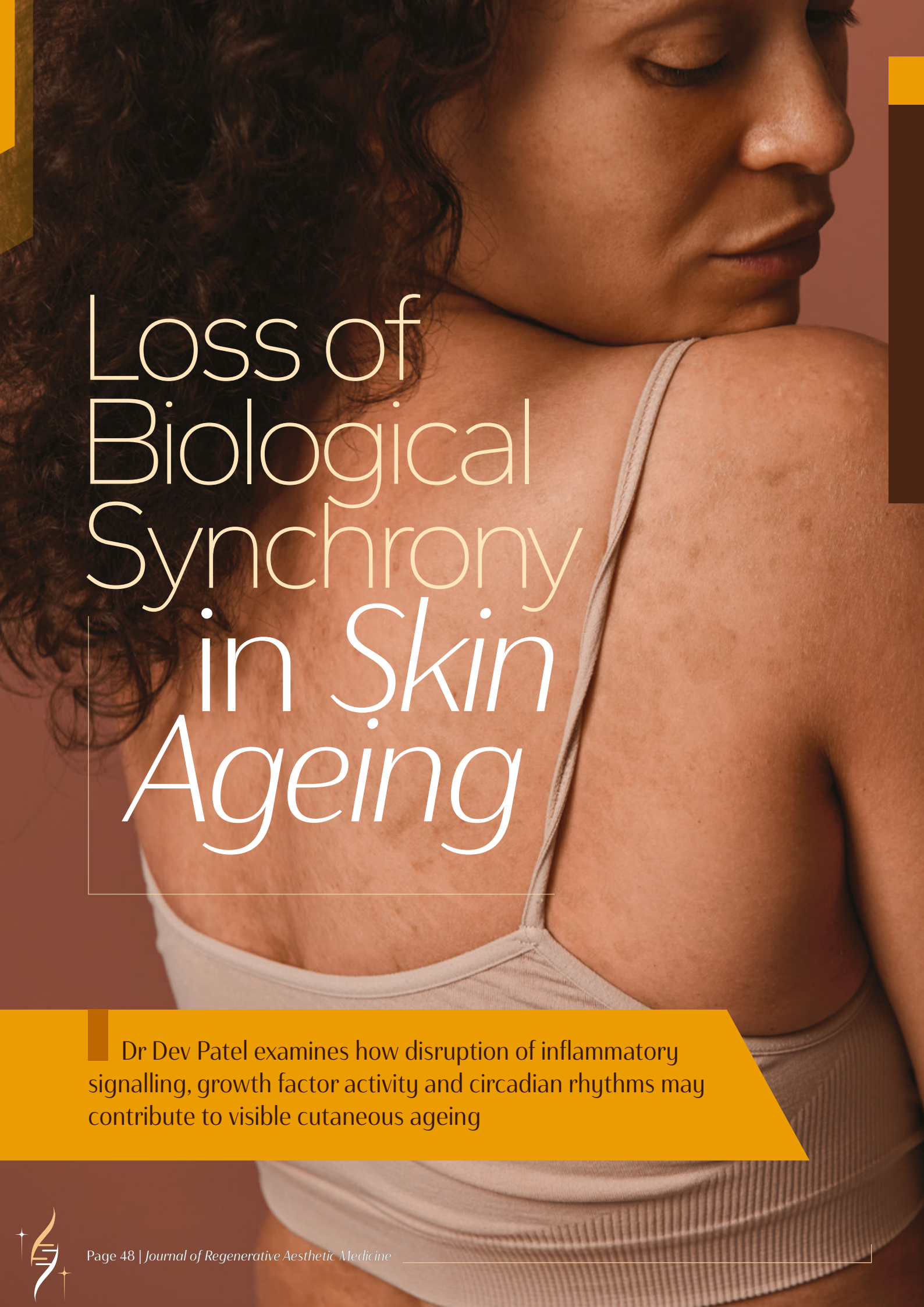

Loss of Biological Synchrony in *Skin Ageing*

Dr Dev Patel examines how disruption of inflammatory signalling, growth factor activity and circadian rhythms may contribute to visible cutaneous ageing

Abstract

Skin ageing has traditionally been attributed to cumulative cellular damage and progressive loss of regenerative capacity. Increasing biological evidence now indicates that most cutaneous cells retain functional potential throughout life, while the regulatory systems coordinating repair, renewal, and remodelling progressively deteriorate. This article proposes loss of biological synchrony – the breakdown of precise molecular timing across inflammatory, regenerative, circadian, and extracellular matrix signalling pathways – as a central driver of skin ageing. The interconnected roles of chronic inflammation, senescent cell signalling, impaired growth factor responsiveness, and circadian disruption are examined as mechanisms producing visible ageing phenotypes. Understanding ageing as regulatory failure rather than cellular exhaustion reframes regenerative aesthetics toward restoration of signalling homeostasis and tissue rhythm rather than structural replacement alone.

Clinical Significance

- Ageing reflects dysregulated biological timing rather than loss of regenerative ability
- Chronic inflammation disrupts repair sequencing
- Senescent cells distort the tissue microenvironment
- Growth factor resistance impairs coordinated regeneration
- Circadian disruption reduces nocturnal repair efficiency

Introduction

For decades, skin ageing has been interpreted primarily as a passive and inevitable decline driven by cumulative molecular damage and progressive cellular exhaustion.[1] This framework assumes that fibroblasts gradually lose their capacity to synthesise collagen, keratinocyte turnover slows irreversibly, and stem cell populations diminish to the point of functional insufficiency.[2] However, growing biological evidence now challenges this simplistic attrition model. Numerous studies demonstrate that most cutaneous cells remain capable of robust regenerative responses when exposed to appropriate molecular stimuli, even in advanced age.[3]

Rather than intrinsic cellular failure, ageing skin increasingly appears characterised by deterioration of the regulatory networks that coordinate tissue maintenance and repair.[4] In this context, ageing represents a systemic failure of biological communication rather than uniform loss of cellular potential.[5] The progressive disruption of molecular timing across inflammatory, metabolic, regenerative, and circadian pathways may therefore be conceptualised as loss of biological synchrony, a regulatory collapse that underpins visible cutaneous ageing.[6]

Coordinated regeneration in youthful skin

Young skin functions as a dynamic regenerative organ rather than a static protective barrier.[7] Following environmental injury or routine microdamage, inflammatory mediators are rapidly released to initiate immune surveillance, clear debris, and prepare tissue for repair.[8] This inflammatory phase is tightly controlled and swiftly transitions into a proliferative phase driven by growth factor release, stimulating fibroblast migration, keratinocyte proliferation, angiogenesis, and extracellular matrix synthesis.[9] Once repair is achieved, pro-resolution pathways actively suppress inflammation to prevent fibrosis, scarring, and chronic tissue stress.[10]

This regenerative cascade is orchestrated by precisely timed signalling among key growth factor families including epidermal growth factor (EGF), fibroblast growth factors (FGFs), insulin-like growth factor-1 (IGF-1), and vascular endothelial growth factor (VEGF).[11] Simultaneously, extracellular matrix proteins provide not only mechanical integrity but also biochemical feedback, regulating cell migration, differentiation, and survival.[12] Through these interlinked feedback loops, skin maintains continuous renewal while preserving structural stability and barrier function.[13]

Crucially, these regenerative processes occur rhythmically rather than continuously. Circadian signalling, mechanical forces, and metabolic cues determine when inflammation is activated, when repair is initiated, and when remodelling is completed.[14] Youthful skin therefore operates through highly synchronised biological timing systems that ensure efficient regeneration with minimal collateral damage.

Regulatory breakdown in ageing skin

With advancing age, the fundamental cellular machinery responsible for

regeneration remains largely preserved.[15] Fibroblasts continue to synthesise collagen when appropriately stimulated, keratinocytes retain responsiveness to mitogenic cues, and stem cell populations persist despite functional attenuation.[16-18] The dominant biological shift lies not in loss of these cells but in progressive dysregulation of signalling fidelity, amplitude, and temporal coordination.[19]

Chronic elevation of inflammatory mediators produces sustained low-grade tissue stress, a phenomenon widely described as inflammaging.[20] Concurrently, growth factor receptor expression declines while downstream intracellular signalling becomes blunted, reducing cellular responsiveness to regenerative cues.[21] Repair signals that once occurred in brief, tightly regulated bursts become prolonged, delayed, or insufficient to fully coordinate regeneration.[22] At the same time, matrix metalloproteinases remain persistently active, tipping tissue balance toward degradation rather than renewal.[23]

The outcome is not regenerative failure but mistimed regeneration occurring alongside excessive breakdown, producing progressive structural deterioration despite ongoing biological activity.[24]

Senescence as a driver of desynchronisation

Cellular senescence plays a central role in the collapse of biological synchrony.[25] Senescent fibroblasts and keratinocytes remain metabolically active yet secrete pro-inflammatory cytokines, proteases, and growth-disrupting mediators collectively termed the senescence-associated secretory phenotype (SASP).[26] Rather than passively ceasing function, these cells actively distort the surrounding tissue microenvironment.[27]

SASP factors interfere with growth factor gradients, amplify chronic inflammation, and impair neighbouring

Chronic elevation of inflammatory mediators produces sustained low-grade tissue stress, a phenomenon widely described as inflammaging

cell responsiveness, thereby disrupting coordinated repair processes.[28] This establishes a feed-forward loop in which dysregulated signalling promotes further senescence, perpetuating progressive regulatory collapse.[29] Over time, accumulation of senescent cells transforms skin from a synchronised regenerative system into a chronically inflamed, poorly coordinated tissue environment.

Circadian desynchronisation and impaired repair

Skin regeneration is intimately governed by circadian biology.[30] DNA repair mechanisms, epidermal proliferation, lipid barrier synthesis, and antioxidant activity peak during nocturnal phases.[31] Clock genes such as BMAL1 and CLOCK regulate growth factor release, immune modulation, and cellular metabolism.[32]

Ageing disrupts both the amplitude and phase alignment of these circadian rhythms within cutaneous tissue.[33] As a result, nocturnal repair efficiency declines, oxidative damage accumulates, and recovery from environmental stress becomes increasingly incomplete.[34] Circadian desynchronisation further compounds chronic inflammation and growth factor mis-timing, accelerating visible ageing processes.[35]

Clinical manifestations of lost synchrony

The hallmark features of ageing skin arise directly from regulatory breakdown rather than cellular disappearance.[36] Although collagen production persists, it is overwhelmed by chronic enzymatic degradation.[37] Pigment signalling becomes erratic, producing uneven melanocyte activity and patchy hyperpigmentation.[38] Barrier repair slows significantly, increasing transepidermal water loss and susceptibility to inflammatory insults.[39]

Thus, ageing skin remains biologically active yet functionally mistimed, caught in a state of perpetual low-grade injury without efficient resolution.[40]

Regenerative therapies as signal resynchronisation

Understanding ageing as loss of biological synchrony fundamentally reframes therapeutic strategy.[41] Rather than focusing solely on replacing volume or ablating damaged tissue, modern regenerative approaches aim to restore physiological signalling cascades.[42]

Growth factor-based therapies reintroduce missing regenerative cues to stimulate coordinated repair.[43] Energy-based devices leverage controlled microinjury to re-initiate synchronised wound-healing cycles.[44] Biological modulators such as peptides and extracellular vesicle mediators influence intracellular signalling fidelity and receptor responsiveness.[45]

The therapeutic objective becomes restoration of proper timing between inflammation, repair, and remodelling rather than forced tissue replacement.[46]

Implications for longevity medicine

This regulatory model aligns closely with emerging geroscience frameworks across multiple organ systems.[47] Ageing is increasingly recognised as a consequence of disrupted intercellular communication rather than irreversible cellular depletion.[48] Restoration of signalling homeostasis has demonstrated

tissue rejuvenation in muscle, liver, nervous tissue, and skin models.[49]

Skin therefore provides a visible and accessible model for studying systemic ageing biology and regenerative intervention.[50]

Conclusion

Skin does not age primarily because its cells lose regenerative capacity.[51] Instead, ageing reflects progressive loss of precision in the molecular coordination governing repair and renewal.[52] Chronic inflammation, senescent signalling, impaired growth factor responsiveness, and circadian disruption collectively drive loss of biological synchrony.[53]

Regenerative aesthetics should therefore focus on restoring biological rhythm and signalling integrity rather than structural replacement alone.[54] The future of skin longevity lies in resynchronising regenerative systems that remain inherently capable of renewal.[55]

Ageing is increasingly recognised as a consequence of disrupted intercellular communication rather than irreversible cellular depletion

"This review article offers an interesting overview of the biochemical and cellular mechanisms involved in ageing, covering a broad range of relevant areas within the field.

The discussion surrounding circadian ageing processes is particularly thought-provoking and highlights an area of growing scientific interest. It will be interesting to see how future research further explores the potential clinical relevance of these mechanisms within aesthetic and regenerative medicine.

Overall, the article provides readers with a valuable narrative perspective on the biological processes that contribute to ageing and the evolving scientific concepts shaping the field."

Professor Maurizio Cavallini, Scientific Committee

Dr Dev Patel BSc(Hons) MBBS Dip IMC RCS(Ed) DFFP Dip PgDerm MRCGP DOccMed MBCAM is an award-winning aesthetic doctor, educator, and international speaker. He holds an Honours Degree in Genetics and qualified in medicine from Guy's, King's & St Thomas' in London. He also has a post-graduate diploma in dermatology from Cardiff University. He is Founder and Medical Director of the multi-award-winning Perfect Skin Solutions, and creator of CellDerma - a regenerative skincare brand focused on growth factor innovation. Widely recognised for pioneering technologies such as gas plasma and being among the first to introduce several globally acclaimed aesthetic systems to the UK, Dr Patel is also a trainer and faculty member for leading brands including Merz. His work bridges advanced science, aesthetic artistry, and the psychology of beauty.

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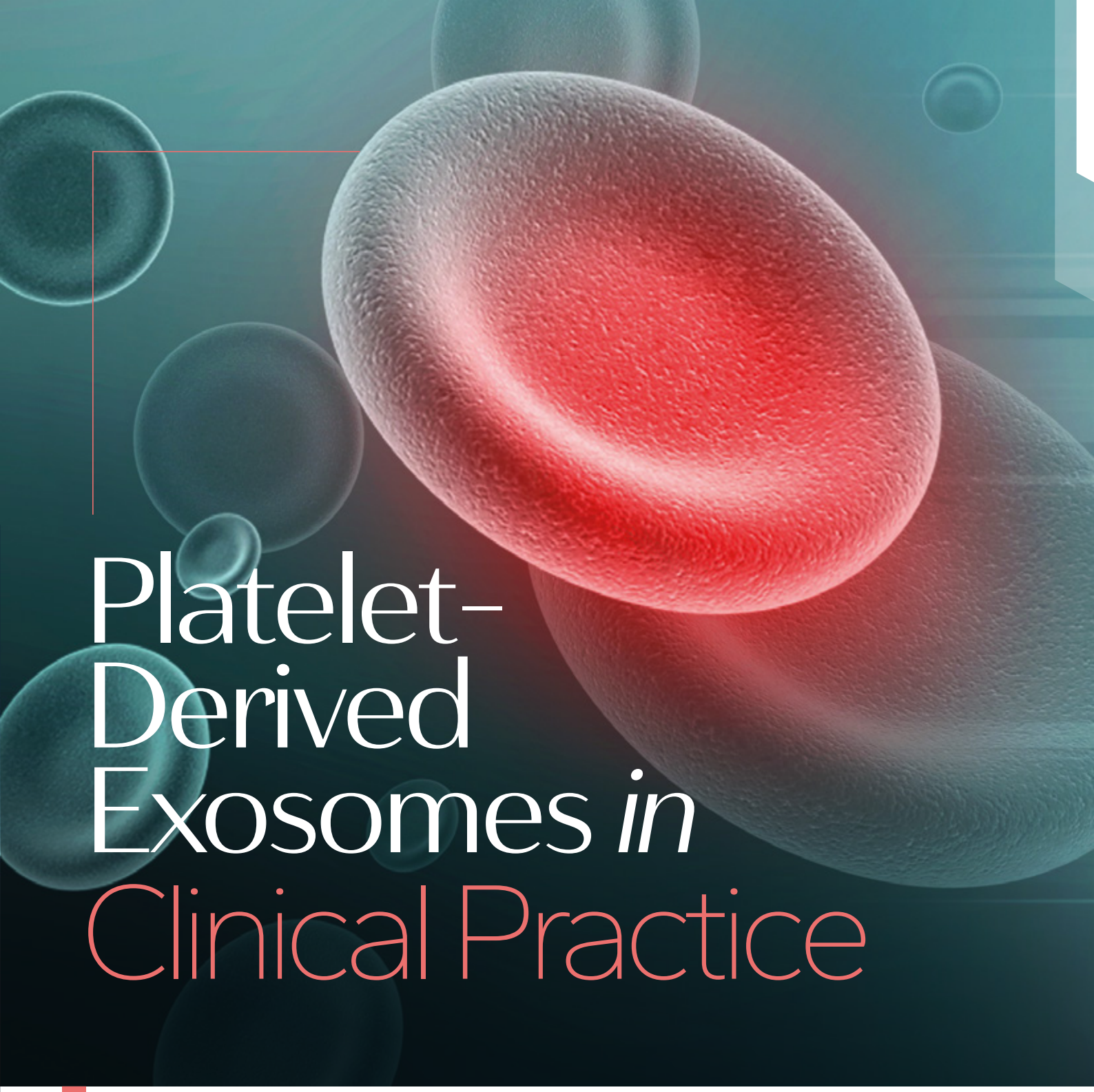

Platelet-Derived Exosomes *in* Clinical Practice

Dr Memee Ahmad explores the biological rationale, clinical application and emerging evidence behind platelet-derived exosomes, and their role as a refinement of platelet-based therapies

Introduction

Platelet-derived exosomes are nanoscale extracellular vesicles released by activated platelets. Unlike passive cellular debris, they are actively assembled, membrane-bound structures containing a complex biological cargo, including growth factors, lipids, signalling proteins and nucleic acids such as microRNA.[1,2] This cargo underpins their regenerative relevance, enabling intercellular communication and modulation of tissue repair pathways.

What distinguishes exosomes from more traditional platelet-based therapies such as platelet-rich plasma (PRP) is

their structure and mode of action. PRP primarily acts through the release of soluble growth factors following platelet activation, whereas exosomes provide a protected delivery system for biologically active molecules.[3] Their lipid bilayer membrane helps shield this cargo from degradation and facilitates transfer to recipient cells, where it may influence gene expression, inflammation, angiogenesis and extracellular matrix remodelling.[2,4]

This distinction has prompted growing interest in platelet-derived exosomes as a potentially more refined extension of platelet-based regenerative treatment. Rather than functioning solely as a reservoir of growth factors, they are increasingly understood as signalling mediators capable of influencing the tissue microenvironment in a more targeted way.[5]

Biological rationale and mechanism of action

The regenerative potential of platelet-derived exosomes lies in their ability to influence cellular behaviour at a molecular level. Once released, these vesicles interact with target cells through membrane fusion, receptor binding or endocytosis, enabling the transfer of their internal cargo into the intracellular environment.[1,2] This process allows exosomes to act as mediators of cell-to-cell communication, coordinating tissue repair responses.

MicroRNA plays a particularly important role in this mechanism. These small, non-coding RNA molecules regulate gene expression post-transcriptionally, allowing exosomes to modulate key pathways involved in inflammation, fibroblast activity and extracellular matrix turnover.[3] Through this signalling capacity, platelet-derived exosomes may contribute to collagen synthesis, angiogenesis and overall dermal regeneration.[4]

I utilise the Arthrex ACP Max system, which employs a closed, double-spin centrifugation protocol

In addition to nucleic acids, exosomes contain a range of bioactive proteins and lipids that further support their regenerative function. Unlike freely circulating growth factors, which are rapidly degraded within the tissue environment, encapsulated signalling molecules are protected and delivered in a more controlled and sustained manner.[2] This may enhance both the duration and specificity of their biological effect.

Importantly, this mechanism reflects a shift in how platelet-based therapies are understood. Rather than acting purely through growth factor release, increasing evidence suggests that extracellular vesicles, including exosomes, play a central role in mediating many of the downstream regenerative effects observed with platelet-derived treatments.[5]

From PRP to vesicle-enriched preparations

Platelet-rich plasma (PRP) remains one of the most widely used regenerative treatments in aesthetic medicine, with established applications in skin rejuvenation, wound healing and hair restoration.6 Its clinical effect is largely attributed to the release of growth factors following platelet activation, which stimulate cellular activity and support tissue repair.[7]

However, variability in PRP preparation has been widely recognised as a limitation. Differences in centrifugation protocols, platelet concentration and leucocyte content can significantly influence the biological profile of the final product and clinical outcomes.[8]

Leucocyte-rich preparations, in particular, may induce a more pronounced inflammatory response due to the presence of neutrophils and other inflammatory mediators.[9] While this may be beneficial in certain therapeutic contexts, in aesthetic practice the aim is typically to promote regeneration while minimising inflammation and downtime.

As a result, there has been a shift towards more refined preparation techniques designed to produce leucocyte-poor platelet concentrates with improved consistency. Double-spin centrifugation protocols and closed-system technologies allow for greater standardisation, reducing operator-dependent variability and supporting more reproducible outcomes.[8]

Within these refined preparations, extracellular vesicles, including exosomes, are present as part of the platelet secretome. Increasing attention is now being directed towards their contribution to the regenerative effects observed with PRP, with some authors suggesting that they may play a more central role than previously recognised.[10]

Preparation and standardisation in clinical practice

In clinical practice, the preparation of platelet-derived exosome-enriched treatments differs from laboratory-based isolation techniques. While research environments allow for precise separation and characterisation of extracellular vesicles, such processes are not feasible at the point of care. Instead, clinicians work with platelet-derived preparations that are enriched in biologically active components, including extracellular vesicles, within a broader secretome.

In my own practice, I utilise the Arthrex ACP Max system, which employs a closed, double-spin centrifugation protocol. Treatment typically begins with a blood draw in the region of 60-90mL, although smaller volumes may be used depending

on the indication. The initial centrifugation separates the red blood cell fraction from the platelet-rich layer. This is then transferred for a second, lower-speed spin to further refine the preparation.

This process results in a concentrated platelet fraction with a marked reduction in red blood cells and granulocytes, including neutrophils, reported to be in the region of 98%, while platelet concentration is increased above baseline levels.[11] The resulting preparation is enriched in platelet-derived components while limiting the presence of additional cellular elements.

From a practical perspective, the use of a closed system supports sterility and allows the entire process, from blood draw to reinjection, to be completed within a single treatment session. This facilitates integration into clinical workflow while maintaining a controlled and reproducible preparation process.

This distinction is important when interpreting both clinical outcomes and the current evidence base, as the effects observed are likely the result of multiple interacting components within the platelet secretome rather than a single isolated factor.

Evidence base and current limitations

Preclinical evidence supporting the regenerative potential of platelet-derived exosomes is growing. In vitro and animal studies have demonstrated their ability to enhance fibroblast proliferation, stimulate collagen synthesis, promote angiogenesis and accelerate wound healing.[9,10] These effects are largely attributed to their capacity to modulate key cellular signalling pathways involved in tissue repair.

Exosomes have also been shown to influence inflammatory responses, with experimental models demonstrating protective effects in environments characterised by cytokine-driven inflammation.[11] This supports the hypothesis that extracellular vesicles play a central role in coordinating regenerative processes, rather than acting solely as passive carriers of growth factors.

From a practical perspective, the use of a closed system supports sterility and allows the entire process, from blood draw to reinjection, to be completed within a single treatment session

However, translation into clinical practice remains limited. While early clinical observations and small-scale studies suggest potential benefits in indications such as skin rejuvenation and hair restoration, there is a lack of large, randomised controlled trials within aesthetic medicine.[12]

In addition, variability in preparation methods, dosing strategies and outcome measures continues to present a challenge. Differences in how platelet-derived products are processed and delivered make it difficult to directly compare findings across studies or establish standardised treatment protocols.[8]

As a result, current use of platelet-derived exosome-enriched treatments should be considered within the context of an evolving evidence base. Careful patient selection, transparent communication and realistic expectation setting remain essential while further clinical data are established.

Clinical application and patient selection

In clinical practice, platelet-derived exosome-enriched treatments are typically delivered using protocols adapted from platelet-rich plasma, with injection technique, treatment interval and overall course tailored to the indication. Treatment is usually performed as a series, with sessions spaced over several weeks, followed by maintenance based on individual response and treatment goals.

A comprehensive patient assessment is essential to optimise outcomes. As an autologous therapy, treatment efficacy is influenced by systemic factors including overall health, inflammatory status, nutritional profile and lifestyle.[13] Where appropriate, baseline investigations may support treatment planning and help identify patients who are most likely to benefit.

From a clinical perspective, there are specific patient profiles where exosome-enriched preparations may offer advantages. Individuals with sensitised or inflammation-prone skin, for example, may benefit from approaches that aim to support regeneration while minimising inflammatory burden.

Hair restoration is another area of interest. Androgenetic alopecia is increasingly understood as a condition involving complex signalling and transcriptional dysregulation rather than simply reduced growth factor availability.[14] The ability of exosomes to influence gene expression via microRNA may therefore offer a more targeted approach to supporting follicular function.

In addition, their small size and role in intercellular signalling make them suitable for use in delicate anatomical areas, such as the periocular region, where minimising downtime and maintaining tissue integrity are key considerations.

Clinical integration and protocol considerations

The integration of platelet-derived exosome-enriched treatments into clinical practice is achievable but requires investment in both infrastructure and clinical understanding. It is not a simple

add-on procedure, involving additional time, equipment and practitioner expertise.

From a practical perspective, the full treatment process, from blood draw through to reinjection, typically takes between 30 and 45 minutes. This must be factored into appointment scheduling, alongside appropriate patient preparation, including hydration and the avoidance of medications that may affect platelet function.

Patient education is equally important. Outcomes are gradual and not directly comparable to more immediate aesthetic interventions such as dermal fillers. Setting realistic expectations is therefore essential, particularly when introducing regenerative approaches to patients who may be more familiar with volumisation-based treatments.

At present, there is no universally agreed protocol for dosing or treatment frequency. Clinical decision-making is guided by practitioner experience, existing PRP literature and an understanding of regenerative biology. A thorough patient assessment remains central to this process, including medical history, baseline skin condition and, where appropriate, blood analysis to support optimisation of treatment outcomes. Objective imaging and measurement tools may also be used to establish baseline parameters and track clinical response over time.

Initial protocols commonly involve sessions spaced at four- to eight-week intervals, followed by maintenance treatments depending on individual response and clinical indication.

Injection technique is tailored to the treatment objective. Superficial intradermal delivery is typically used for skin quality and texture, while deeper placement may be considered where broader regenerative effects are desired. Importantly, increasing volume or frequency does not necessarily improve outcomes. Excessive dosing may increase inflammatory burden or reduce treatment efficacy, highlighting the need for a measured and individualised approach.

Safety, limitations and clinical responsibility

As an autologous treatment, platelet-derived exosome-enriched therapies are associated with a favourable safety profile. The use of the patient's own biological material reduces the risk of immunogenic reaction, while closed-system preparation supports sterility and minimises the potential for contamination.[13,16]

Despite this, appropriate patient selection remains essential. Individuals with platelet dysfunction, thrombocytopenia, active infection or underlying conditions that may impair healing should be approached with caution or excluded from treatment.[13,17]

Beyond patient factors, there are broader limitations that clinicians must consider. The current evidence base, while promising, is still evolving, with a lack of large-scale, standardised clinical trials in aesthetic indications. Variability in preparation methods and treatment protocols further complicates interpretation of outcomes and comparison between studies.

There is also increasing ambiguity surrounding the use of the term "exosomes" within the aesthetic sector. It is applied across a wide range of products and technologies, not all of which represent true extracellular vesicles or demonstrate equivalent biological activity. This makes it essential for clinicians to critically evaluate both the scientific validity and regulatory status of any treatment or system prior to use.

Maintaining an evidence-led approach is therefore central to responsible practice. This includes transparent patient communication, realistic expectation setting and a commitment to ongoing evaluation of clinical outcomes. As interest in regenerative treatments continues to grow, preserving scientific integrity will be key to ensuring both patient safety and the long-term credibility of the field.

Future directions

Platelet-derived exosomes are unlikely to replace platelet-rich plasma entirely, but instead represent a refinement of platelet-based therapies. Their ability to deliver protected, biologically active cargo and influence cellular signalling pathways offers a potentially more targeted approach to tissue repair and regeneration.

As the field evolves, advances are likely to focus on improved standardisation of preparation techniques and greater understanding of dose-response relationships. The development of technologies capable of characterising extracellular vesicle content in real time may support more precise and reproducible treatment protocols in the future.

Setting realistic expectations is therefore essential, particularly when introducing regenerative approaches to patients who may be more familiar with volumisation-based treatments

There is also growing interest in personalised regenerative strategies. As understanding of tissue biology deepens, treatment approaches may increasingly be tailored to individual patient profiles, incorporating factors such as inflammatory status, metabolic health and specific clinical indications.

However, it is critical that clinicians

working in this space are not simply the fastest adopters of new technologies. There must be a commitment to interrogating the evidence, rigorously documenting outcomes and maintaining scientific integrity, even when this is inconvenient.

Ultimately, the progression of platelet-derived exosome-based treatments will depend on the generation of high-quality clinical evidence. Well-designed, randomised controlled trials with standardised methodologies and long-term follow-up will be essential in establishing their role within clinical practice.

As regenerative approaches continue to gain traction, maintaining a focus on evidence, transparency and patient-centred care will be critical. When applied appropriately, platelet-derived exosomes may contribute to a more biologically aligned approach to aesthetic treatment, supporting tissue function and quality over time rather than relying solely on corrective interventions.

Ultimately, the progression of platelet-derived exosome-based treatments will depend on the generation of high-quality clinical evidence

Dr Memee Ahmad specialises in regenerative aesthetics, with a background in general practice. Her work focuses on the application of evidence-based regenerative approaches to support skin health and optimise long-term tissue function.

She incorporates a range of modalities into clinical practice, including exosomes, polynucleotides, platelet-rich plasma (PRP) and radiofrequency microneedling, selecting treatments based on individual patient assessment and indication.

Dr Ahmad's approach emphasises personalised treatment planning, informed by detailed skin analysis and an understanding of underlying biological processes, with the aim of supporting tissue repair, regeneration and overall skin quality.

"This is a well-written article that provides an excellent overview of platelet-derived exosomes and their emerging role within regenerative aesthetics.

The discussion surrounding PRP variability is especially strong and reflects challenges frequently observed in clinical practice, reinforcing the idea that regenerative outcomes are influenced by complex biological interactions rather than a single component alone.

The article also encourages important discussion around the future direction of regenerative therapies, including the need for greater understanding of extracellular vesicles, clearer terminology, improved standardisation and the practical integration of these treatments into clinical practice. It will be interesting to see how future research further explores how platelet-derived exosomes compare with well-prepared PRP protocols, alongside the governance and evidence frameworks needed to support wider adoption."

Claudia McGloin, Advisory Contributor

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Clinical insights into Substrate-Based Skin Biorestoration with **Celora Vita™**

Dr Raquel Amado explores the biological rationale for using an amino-acid and low-molecular-weight hyaluronic acid-based product to support extracellular matrix renewal and the dermal environment, supported by two case studies

Skin ageing is increasingly recognised as a biologically driven process involving progressive dysregulation of the dermal microenvironment, rather than simply the accumulation of surface-level structural changes. Chronic low-grade inflammation, oxidative stress, reduced fibroblast metabolic activity and degradation of the extracellular matrix (ECM) contribute to declining hydration, elasticity, luminosity and overall skin resilience.[1-4]

In response, biorestoration strategies that aim to restore dermal function rather than correct isolated surface features have gained clinical relevance.[5] Clinical research evaluating Celora Vita™ has demonstrated histological, instrumental and clinical findings consistent with increased fibroblast activity, collagen type III production, angiogenesis, epidermis thickness leading to improved hydration, radiance, firmness and texture as well as significant improvement in fine lines and wrinkles.[6-8]

Biological properties of Celora Vita™ and their role in skin renewal

Celora Vita™ is positioned as a substrate-based biorestorative injectable, combining a defined complex of nine amino acids and low-molecular-weight hyaluronic acid to support dermal biology rather than induce volumisation.[5] This approach reflects an evolving understanding of skin ageing as a process driven by progressive impairment of fibroblast function, ECM turnover, hydration regulation and, importantly, substrate depletion[1,4,9]

Amino acids act as essential substrates for collagen, elastin and keratin synthesis.[10-12] With increasing age, amino-acid availability within the dermis declines, becoming a limiting factor for effective ECM renewal even when fibroblasts remain viable.[4,9,13] This substrate deficiency is particularly relevant in chronically inflamed or photoaged skin, where protein turnover is increased and regenerative demand exceeds supply or when lifestyle factors have an impact; such as poor nutrition.[14]

The amino acid complex within Celora Vita™ is designed to supply substrates relevant to collagen synthesis, fibroblast metabolism and epidermal support.9,10 While fibroblasts retain regenerative potential with age, reduced availability of key amino acids can limit effective extracellular matrix (ECM) renewal.[4,9,13] Structural amino acids such as glycine and proline are fundamental to collagen triple-helix formation and stability, comprising a substantial proportion of dermal collagen content.10 Lysine plays an essential role in collagen cross-linking and matrix maturation, contributing to tensile strength and dermal integrity.15,16 Branched-chain amino acids including leucine, isoleucine and valine support cellular protein synthesis and metabolic activity, influencing fibroblast function and tissue repair capacity.[17] Their relevance may increase with age, as protein synthesis efficiency declines despite the presence of viable fibroblast populations.[13] Amino acids such as alanine and serine contribute to epidermal metabolism and hydration through their role in natural moisturising factor (NMF) composition and barrier support.[8,19] Cysteine, a sulphur-containing amino acid, contributes to redox balance and keratin synthesis and plays a role in protecting cells from oxidative stress - an important consideration in environmentally stressed or inflamed skin.[3,12]

Alongside amino acids, low-molecular-weight hyaluronic acid plays a key role in optimising the dermal microenvironment.[20] In contrast to high-molecular-weight hyaluronic acid, which primarily provides viscoelastic support, lower-molecular-weight fragments are more biologically active within the dermis.[21] These fragments are able to distribute more readily throughout the ECM and interact with fibroblast surface receptors such as CD44, influencing cellular signalling pathways involved in matrix remodelling, hydration balance and tissue repair.[22]

Both medical and nursing regulators require practitioners to have adequate and appropriate indemnity arrangements in place

By delivering a defined combination of these amino acids directly into the dermis, Celora Vita™ aims to support fibroblast activity and ECM synthesis by addressing substrate limitation, particularly when combined with low-molecular-weight hyaluronic acid to optimise the dermal microenvironment.[9,20]

Translating mechanism into patient selection

The substrate-based mechanism of Celora Vita™ has clear implications for patient selection and treatment positioning. Because its effects are mediated through optimisation of fibroblast activity, ECM renewal and hydration regulation - rather than volumisation or structural correction - clinical benefit is most evident in patients where skin quality decline reflects biological fatigue rather than architectural loss.[1,18]

In clinical practice, this includes patients presenting with marked dehydration and dull or fatigued skin, where impaired dermal hydration regulation contributes to reduced luminosity and resilience.[18] It is also well suited to patients with fine lines associated with dermal thinning and ECM exhaustion, particularly where volume loss or dynamic muscle activity is not the dominant driver of ageing.[23] As well as this, Celora Vita™ is appropriate for patients with uneven tone or texture, and early to moderate chrono/photoageing.[14]

The formulation also lends itself to early intervention and prejuvenation strategies, where the aim is to preserve dermal quality and delay progression of visible ageing.[14] Delicate anatomical

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areas, such as the periocular region, may particularly benefit from this approach, as ECM support can be improved without introducing volume in tissues where volumisation is undesirable.[23]

Understanding Celora Vita™ as a biorestorative solution rather than corrective intervention is essential for appropriate expectation management. Improvements typically develop progressively over weeks to months, in line with known biological timelines for ECM remodelling and fibroblast-mediated repair, rather than producing immediate structural change.[1,4]

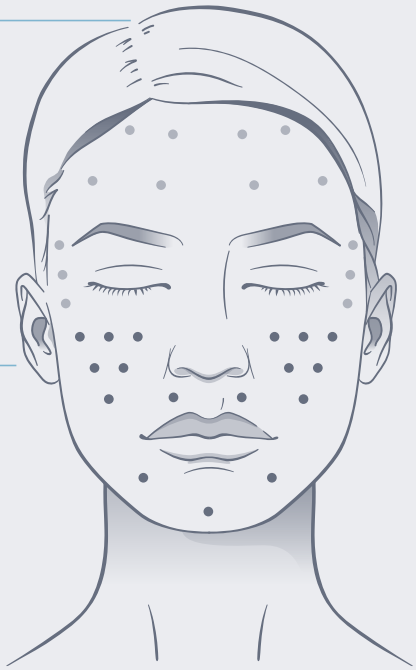
Treatment protocol

Pre-Treatment Preparation

- A topical numbing cream is applied around 30 minutes before the procedure.
- This helps minimise discomfort, as multiple small intradermal injections are performed, and ensures the treatment is as comfortable as possible for the patient.

Injection Technique

Treatment frequency:
3-4 weeks apart



Post-Treatment Guidance

- Patients are advised to avoid applying makeup or skincare products until the following day.
- Alcohol consumption, strenuous physical activity, and exposure to excessive heat (e.g. saunas, steam rooms) should be avoided for 24 hours post-procedure.
- Standard post-injectable aftercare instructions are provided as part of routine clinical practice.

Case studies

The following cases are drawn from my early clinical experience with Celora Vita™, in which I was involved in both case evaluation and protocol development, and are presented to illustrate clinical application in patients selected in line with the biological rationale and clinical research outlined earlier in this article.

Patient 1: skin biorestoration in dehydrated, inflamed skin

Patient presentation: The patient presented with moderate skin ageing characterised by marked dehydration, dull and fatigued appearance, fine lines and wrinkles, uneven skin texture and reduced firmness and elasticity. Clinical assessment suggested features of both photoageing and chronoageing, alongside background inflammation and oxidative stress. Overall, the presentation was consistent with impaired dermal function and extracellular matrix fatigue rather than isolated volume loss or dynamic line formation.

Treatment rationale: Based on the substrate-based mechanism of Celora Vita™, a biorestorative approach was selected to support complete ECM renewal and the dermal environment.[5]

Clinical observations: An early improvement in skin luminosity was observed following the first treatment session, with visible improvement noted at the two-week review. Over the course of the treatment protocol, progressive improvements were observed in skin brightness, smoothness and overall texture.

A reduction in background erythema was also noted, suggesting improved dermal balance. Subjectively, the patient reported positive feedback from others regarding overall skin appearance, consistent with global improvement in skin quality rather than change in a single isolated feature.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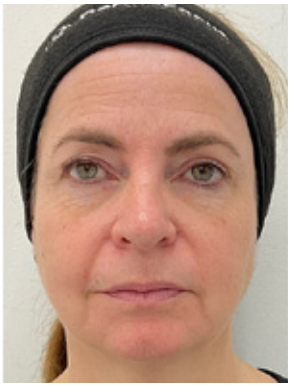
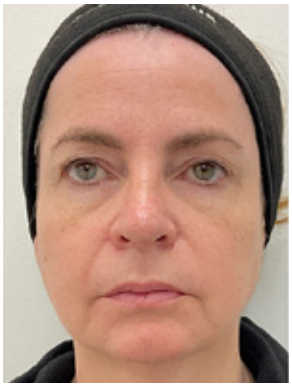
Patient 2: skin biorestoration in periocular ECM fatigue

Patient presentation: The patient presented primarily with fine lines and wrinkles in the periocular region. Baseline skin hydration was good, but there was evidence of mild erythema and pigmentation irregularities. Botulinum toxin treatment was not considered appropriate due to the patient's brow position. Despite adequate hydration, clinical assessment suggested localised ECM fatigue and reduced dermal support, particularly within the thin periocular skin.





Treatment rationale: In this case, Celora Vita™ was selected to address matrix quality rather than hydration alone. Age-related reductions in amino-acid availability and fibroblast efficiency can limit effective collagen synthesis even in well-hydrated skin, contributing to persistent fine lines in delicate anatomical areas.[4,9]

The substrate-based mechanism of Celora Vita™ offered a means of supporting fibroblast activity and dermal structure without introducing volume in a region where volumisation would be undesirable.

Clinical observations: Early improvement was observed following the first treatment session, most notably in the periocular region. Over subsequent weeks, progressive softening of fine lines and improvement in skin smoothness were noted.

Subtle reductions in background redness and mild pigmentation irregularities were also observed. Improvement in forehead lines was limited, reinforcing the importance of appropriate indication selection and realistic expectation management when using biorestorative treatments.

Ongoing clinical evaluation will continue to inform best practice for the use of Celora Vita™, helping to define its role within regenerative approaches to skin quality management

Conclusion

The clinical research and early practice experience demonstrate that Celora Vita™, a substrate-based biorestoration injectable combining amino acids and low-molecular-weight hyaluronic acid, can support improvements in skin quality by addressing underlying biological contributors to ageing such as substrate deficiency and impaired dermal microenvironment dynamics.

The cases presented illustrate how visible responses to Celora Vita™ may vary according to baseline skin condition and regional tissue characteristics, with changes becoming apparent over time in line with biological remodelling rather than immediate correction. These observations reinforce the importance of patient selection, expectation management and interpretation of outcomes within a regenerative, non-volumising treatment framework.

Ongoing clinical evaluation will continue to inform best practice for the use of Celora Vita™, helping to define its role within regenerative approaches to skin quality management.

This advertorial is published in association with DermaFocus – the manufacturer of Celora Vita™. Scan the QR Code to find out more about the product.

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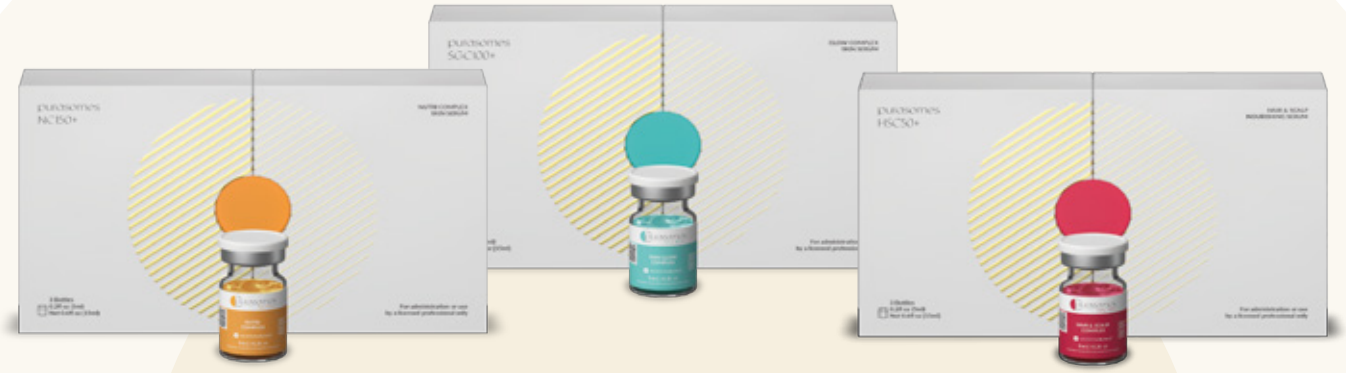

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Regenerative aesthetics has moved quickly over the last decade, but what stands out even more than its speed is how established it now feels

The Expanding Scope of *Informed Consent*

Nurse prescriber and expert witness Jen Vittanuova discusses how informed consent must evolve as regenerative aesthetic treatments become more widely adopted

Regenerative aesthetics is now an established part of aesthetic practice, with treatments such as polynucleotides, platelet rich plasma, exosome-based therapies and collagen-stimulating agents increasingly used to influence tissue quality rather than simply alter structure.

Because these treatments rely on biological response, outcomes are gradual and variable. That variability isn't a weakness, but it does change what patients need to understand

before proceeding. This article explores how informed consent in regenerative aesthetics must extend beyond procedural risks to include discussion of mechanism, timeframe, durability, evidence maturity and regulatory context.

As the field continues to evolve, clear and proportionate communication becomes central to its credibility and long-term development.

The rapid development of regenerative treatments and their place in aesthetics

Regenerative aesthetics has moved quickly over the last decade, but what stands out even more than its speed is how established it now feels. Treatments such as polynucleotides, platelet rich plasma, exosome-based therapies and collagen-stimulating agents are no longer side conversations. They're being built into long-term treatment plans and used with the intention of improving tissue quality, not just changing shape.

That shift says something important about where aesthetic medicine is heading. We're no longer focused purely on structural correction, we're working with biology. Before going further, it is worth pausing on what we mean by regenerative aesthetics. The term is often used broadly, and sometimes loosely. At its core, regenerative practice aims to stimulate or support the body's own repair mechanisms rather than replace what has been lost.[1]

As our understanding of ageing has evolved, it is clear that volume loss is only part of the picture. Fibroblast activity declines, collagen production reduces and the extracellular matrix gradually degrades, leading to visible changes in skin quality over time. Regenerative treatments aim to influence these biological processes rather than simply mask their effects.[2,3]

Traditional structural treatments focus on repositioning or replacing tissue. Regenerative modalities instead seek to modulate cellular signalling, fibroblast activity and extracellular matrix behaviour to support tissue repair and remodelling.[2,3] Because these approaches rely on biological processes rather than immediate structural change, outcomes are inherently more gradual and variable.

Explaining biological variability to patients

This introduces an important point that must be communicated clearly to patients: variability is part of how regenerative treatments work. Unlike traditional volumising procedures, these modalities rely on the individual's biological response. Collagen synthesis takes time, and growth factor signalling differs between patients. Even when histological studies demonstrate increased collagen deposition, the visible outcome may not appear identical in every individual.[4,5] This variation is a reflection of normal biological diversity.

The challenge isn't removing variability, because that's not realistic, the challenge is explaining it clearly. Variability exists on several levels. Some of the key factors include:

- Age influencing fibroblast density and responsiveness[6]
- Smoking status impacting microvascular perfusion[7]
- Metabolic health and systemic inflammation altering wound healing dynamics[8]
- Hormonal status changing collagen behaviour[9]
- Sun exposure and skincare adherence modifying how tissue responds to stimulation[10]

Two patients can receive the same product, at the same dilution, injected at the same depth, and still demonstrate different timelines and degrees of visible improvement.

This becomes particularly important when we think about consent. When a treatment produces an immediate structural change, predictability feels more obvious. When it relies on biological stimulation, results tend to appear gradually and sometimes more subtly. One patient may see steady improvement over several months, another may see a softer response despite using the same product and technique. If we describe regenerative treatments in language that suggests immediate, dramatic transformation, we then risk creating expectations that biology can't always match.

There is also a psychological dimension to this. Patients often tolerate swelling, bruising or temporary discomfort because they understand those risks as part of a procedure.

What is harder to tolerate is ambiguity. Subtle improvement can feel like uncertainty. Gradual change can feel like doubt. If that nuance hasn't been explained in advance, the patient may interpret normal biological variation as treatment failure. That gap between expectation and physiology is where dissatisfaction most commonly arises.

Regenerative treatments are also often perceived as more natural or more aligned with the body's own processes. That perception isn't necessarily inaccurate, but it can create an assumption that outcomes will be gentle, predictable and

That shift says something important about where aesthetic medicine is heading. We're no longer focused purely on structural correction, we're working with biology

universally positive simply because they are biologically based.

Natural doesn't automatically mean uniform. Biological compatibility does not equal clinical certainty. Making that distinction clear is part of meaningful consent, particularly in a field that often promotes regeneration as inherently reassuring. As well as knowing a treatment is safe, patients want to know what it's likely to look like, how long it might take, how long it may last, and how strong the evidence is behind it.

Understanding the evolving evidence base

In regenerative aesthetics, those questions are often more significant than the short-term side effect profile. The scientific literature reflects this nuance. Reviews of platelet rich plasma report improvements in skin texture and elasticity, while also noting differences in preparation methods and reporting standards across studies.[4]

Research into collagen-stimulating agents shows increased collagen production, but the degree of visible change still depends on the individual.[5] Exosome research continues to develop, with ongoing discussion about standardisation and consistency.6 None of this weakens regenerative aesthetics, it simply places it within a field that is still evolving and refining itself.

What also emerges from the literature is heterogeneity. Preparation protocols differ. Centrifugation speeds vary. Concentrations are not always standardised. Sample sizes are often modest. Some studies rely on histological or imaging endpoints rather than patient-reported outcome measures. In newer areas such as exosome-based therapies, isolation techniques, purity thresholds and characterisation methods remain under discussion.

Commercial interest and clinical adoption have, in some areas, progressed faster than methodological standardisation. That does not render these treatments unsafe or inappropriate. It does, however, situate them within a spectrum of evidence maturity.

Evidence in medicine ranges from early exploratory data through to large scale, reproducible trials with long-term follow up. Many regenerative modalities sit somewhere in the middle of that spectrum. The biological rationale may be strong. Early clinical data may be promising. Long-term comparative datasets may still be limited.

Under Montgomery, the test is not whether uncertainty exists, but whether that uncertainty would be material to a reasonable person in the patient's position.[11] For some patients, knowing that a treatment has decades of longitudinal data matters. For others, understanding that it is biologically plausible and increasingly adopted may be sufficient. The role of the practitioner is not to overwhelm with academic detail, but to communicate proportionately where a treatment sits within that evidential landscape.

Emerging evidence is not a warning label, it's context. When that context is explained clearly, regenerative practice remains innovative without becoming overconfident. When it is omitted, marketing fills the gap. Consent, in this setting becomes the mechanism by which scientific nuance is translated into patient understanding.

Legal expectations and the standard for informed consent

In the UK, the legal standard for consent was clarified in Montgomery v Lanarkshire Health Board.[11] We're required to make patients aware of material risks and reasonable alternatives, including the option of no treatment at all. Material means information that a reasonable person in that patient's position would consider important. In regenerative practice, what patients often consider important includes predictability, timescale, durability and the strength of supporting evidence, not just complications such as redness, swelling or bruising.

At its core, regenerative practice aims to stimulate or support the body's own repair mechanisms rather than replace what has been lost

The statutory framework supports this. Regulation 11 of the Health and Social Care Act 2008 (Regulated Activities) Regulations 2014 requires valid consent, and Regulation 12 requires safe care and proper risk assessment.[12] Professional guidance from the General Medical Council and the Nursing and Midwifery Council emphasises practising in accordance with the best available evidence and communicating clearly.[13,14] These standards support regenerative innovation by ensuring that it develops responsibly.

From a medico-legal perspective, it is not difficult to imagine the shape of a future complaint in regenerative aesthetics. The allegation is unlikely to centre on catastrophic complication. It is more likely to read: "I wasn't told results might be subtle," or "I thought this would replace filler," or "I didn't realise the evidence was still emerging."

Those concerns are less dramatic but equally significant. They revolve around expectation, not injury. Clear documentation that variability, timeframe, durability and evidence maturity were discussed is good clinical practice.

Practical steps for regenerative consent conversations

So what does effective consent look like in regenerative aesthetic practice? The following principles provide a practical guide.

1. Explain mechanism of action

Detail how the treatment works in straightforward terms. If a modality stimulates collagen, the patient should understand that collagen builds gradually and that response varies. If the treatment uses platelet rich plasma, they should understand that their own biology influences the outcome. Explaining mechanism helps patients understand why results may take time.

In clinic, that explanation might sound simple. "This isn't a filler. It's designed to encourage your skin to produce more of its own collagen. That takes time, and everyone's response is slightly different. Some people see steady change over three to six months. Others see more subtle improvement. We'll review as we go."

2. Make timelines clear

Instead of saying that results "develop over time," it's more helpful to outline what that time may look like. When might they first notice change? When is improvement likely to peak? Will more than one session be required? Being specific reduces the risk of disappointment.

3. Detail durability and maintenance

Durability should also be discussed honestly. Regenerative treatments are often described as longer lasting, but duration varies depending on the modality and the individual. If maintenance is likely, that should be part of the initial conversation rather than an afterthought.

4. Discuss combination approaches

In reality, regenerative modalities are rarely delivered in isolation. They are often combined with structural treatments, devices or ongoing skin health strategies. When treatments are layered, consent needs to address how biological stimulation interacts with other interventions and how outcomes may overlap or evolve together. That broader framing helps patients understand that improvement may be cumulative rather than attributable to a single step.

5. Outline the evidence-base

Evidence matters too. Some regenerative approaches have stronger and longer datasets than others. Patients don't need detailed academic discussion, but they do deserve to know whether a treatment is well established or still building its evidence base. Being open about that strengthens trust rather than weakening it.

Off-label/off-licence use is another area where clarity helps. Off-label prescribing is lawful when clinically justified and supported by appropriate evidence or experience.[13,14] In regenerative practice, where indications are evolving, explaining whether a treatment is being used within its licence or outside it gives patients a clearer understanding of context.

6. Highlight products' regulatory status

Regulatory awareness also plays a role. The Medicines and Healthcare products Regulatory Agency determines how medicines and devices are classified in the UK.[15] As newer regenerative products enter the market, understanding their regulatory status helps distinguish careful medical practice from trends. The medico-legal framework, informed by Bolam v Friern Hospital Management Committee, requires that practice is supported by a responsible body of professional opinion.[16]

7. Consider your marketing language

Marketing is part of the ecosystem as well. The Advertising Standards Authority requires that claims are accurate and not misleading.[17] When promotional language reflects scientific reality, the consultation becomes an extension of that honesty rather than a correction of exaggeration. If regeneration is presented publicly as guaranteed rejuvenation, consent becomes damage control. If it is presented as biologically guided improvement with inherent variability, consent becomes a continuation of that same message.

8. Ensure clear documentation of discussions

In regenerative aesthetics, that support comes not only from published data but from clear reasoning and careful documentation. Records should reflect that variability, timescale and durability were discussed. Generic phrases don't capture biological nuance.

Explaining mechanism helps patients understand why results may take time

Building credibility through transparent consent

What will define the long-term credibility of regenerative aesthetic treatments is not uniform outcomes, because uniformity is not biologically possible, but the transparency with which we discuss variability and evolving evidence.

Innovation without proportionate communication risks turning regenerative medicine into another cycle of overpromise and correction. If we want this field to mature, we must resist the temptation to present biological stimulation as guaranteed rejuvenation. The science is promising. The biology is complex. Consent is where that complexity must be respected.

Informed consent sits within the wider framework of clinical governance and professional oversight. These considerations are explored further in Eddie Hooker's article on governance in regenerative practice (p.70).

Anna Baker, RGN NIP
Advisory Contributor

"An insightful piece which reinforces due diligence to medical aesthetic practitioners regarding specific factors to include within the consent process, relevant to this evolving and specialised field of practice. Emphasis is placed on providing transparency to patients with guidance around managing patient expectation in terms of timeframe of improvement with regenerative treatments. This paper provides relevant and practical steps to guide clinicians in undertaking rigorous consent for a variety of regenerative procedures."

Innovation without proportionate communication risks turning regenerative medicine into another cycle of overpromise and correction

Jen Vittanuova is a nurse prescriber, clinical director and expert witness with more than 25 years' experience in medical aesthetics and cosmetic surgery. She is known for her clear, practical approach to clinical safety, consent and documentation and regularly speaks at conferences across the UK on risk management and best practice in aesthetics. Alongside her clinical work, Jen provides expert witness reports in cases involving aesthetic treatments and teaches medical professionals through her education brand, Legally Aesthetic. Her style is warm, direct and grounded in real world experience, making complex medico-legal topics accessible and genuinely useful for everyday practice.

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Keeping Pace with Change: Governance in Modern Regenerative Practice

Eddie Hooker details how as treatment portfolios expand and innovation accelerates, practitioners must ensure that clinical training, documentation and professional protections evolve in parallel

The regenerative aesthetic sector continues to evolve at pace. New techniques are introduced, treatment indications broaden, and practitioners increasingly expand their service portfolios across multiple modalities and anatomical areas.

Innovation remains one of the defining characteristics of modern practice. Yet as clinical scope expands, governance frameworks must evolve alongside it. Every new treatment introduced into a clinic influences documentation, consent, delegation structures and risk management processes.

Growth in clinical offering therefore requires parallel growth in oversight. It can alter consent language, complication protocols, escalation pathways and internal audit processes. Even incremental adjustments – such as expanding into a new anatomical area or adapting a protocol – can shift a clinic's overall risk profile.

Governance operates as an active, ongoing process of alignment. Clinical practice, documentation, supervision and professional cover must accurately reflect one another at all times.

Both medical and nursing regulators require practitioners to have adequate and appropriate indemnity arrangements in place

Expanding scope

When practitioners introduce a new treatment or extend into a new clinical area, multiple layers of practice shift simultaneously. Key considerations include:

- **Scope of competence** must be clearly demonstrable. Training should be appropriate to the modality and proportionate to the complexity of treatment. Regulatory guidance emphasises that practitioners must recognise and work within the limits of their competence while keeping knowledge and skills up to date.[1,2] Retained training records and structured CPD form part of a transparent professional framework.
- **Scope of consent** requires active review. National guidance makes clear that patients must be given relevant information about material risks and reasonable alternatives before treatment.[3] Patient information materials should therefore reflect the specific mechanism, expected outcomes and risk profile of each treatment offered. Where protocols combine modalities or expand into new anatomical regions, documentation should mirror that reality.
- **Scope of clinical governance** extends beyond visible procedure. Safe care requires appropriate systems for risk assessment, complication management and escalation.[4] As services evolve, complication protocols, referral pathways and audit systems should be reviewed to ensure they remain appropriate to current practice.
- **Scope of indemnity** must reflect real-world activity. Both medical and nursing regulators require practitioners to have adequate and appropriate indemnity arrangements in place.[1,2] Professional policies are structured around declared treatments and practitioner roles; as services expand or responsibilities shift within the team, policy alignment becomes essential to ensure appropriate protection remains in place.

Each of these elements operates together. When one evolves, the others must follow.

Responsible innovation and development

In a fast-moving field, assumptions can quietly create gaps. A treatment may appear closely related to an existing service. A protocol adjustment may feel incremental. A team member's role may gradually expand in response to demand. Individually, these changes can seem minor. Collectively, they reshape the structure of a practice.

Professional maturity lies in recognising that innovation changes systems, not just techniques.

Structured review must accompany service expansion. This may include formal portfolio audits, documented governance meetings, revision of standard operating procedures and confirmation that consent materials remain accurate and comprehensive. Regulatory guidance consistently emphasises transparency, accountability and patient-centred decision-making as cornerstones of professional practice.[1,3] Embedding those principles within day-to-day operations strengthens both clinical quality and defensibility.

Responsible innovation also requires clarity of language. How treatments are described to patients – whether in consultation or marketing – must align with evidence, regulatory standards and the practitioner's declared scope of practice. Clear communication reduces misunderstanding and reinforces trust.

Equally, leadership within a clinic environment involves ensuring that delegation structures are explicit. Where nurses, therapists or other team members deliver care, supervision, training documentation and indemnity alignment must be clearly defined. As practices scale, informal role expansion can create ambiguity unless governance evolves in parallel.

Importantly, governance should not be viewed as reactive or punitive. It functions as a strategic tool that enables confident growth. Practices that conduct regular internal reviews, map CPD activity against services offered, and confirm policy alignment position themselves to innovate with assurance rather than uncertainty.

National guidance makes clear that patients must be given relevant information about material risks and reasonable alternatives before treatment

Across the sector, professional standards increasingly reflect this expectation of structured oversight.[5] Innovation supported by governance strengthens credibility, protects patients and reinforces the long-term sustainability of aesthetic practice.

An often-overlooked component of that oversight is indemnity alignment. Professional cover is structured around declared treatments, practitioner roles and scope of activity. As services evolve - whether through new modalities, expanded anatomical areas or changes within the clinical team - policies should be reviewed to ensure they accurately reflect the reality of practice.

Policy alignment checklist

Hamilton Fraser notes that one of the most common issues encountered during claims arises when treatments or practitioners have not been accurately declared on a policy.

Professional indemnity policies reflect the services delivered within a clinic. Before introducing a new treatment or expanding your portfolio, consider:

- Have you completed and documented appropriate training?
- Have consent materials and patient information been updated?
- Are complication management protocols aligned with the treatment offered?
- Does your policy accurately list all current treatments?
- ·Are all practitioners and delegated roles correctly declared?

Hamilton Fraser encourages practitioners to review their policy annually and whenever services or team structures change, ensuring professional cover reflects real-world clinical activity.

Protecting progress

The evolution of regenerative aesthetic practice brings opportunity, alongside responsibility.

Alignment between competence, consent, governance systems and indemnity arrangements safeguards patient welfare and reinforces professional credibility. Clear documentation, transparent communication and accurate policy alignment contribute directly to clinical resilience.

Governance functions as a continuous discipline within modern practice. Regular review of training records, consent materials, complication protocols and professional cover ensures that clinical delivery reflects declared scope at all times.

Innovation achieves longevity when embedded within robust frameworks. Sustainable progress in regenerative practice depends on the consistent integration of clinical advancement with structured governance.

For advice on introducing or updating your regenerative aesthetic indemnity policies, scan the QR code.

Informed consent forms a central component of modern clinical governance. These considerations are explored in more depth in Jen Vittanuova's accompanying article on consent in regenerative aesthetics (p.65).

Eddie Hooker is the founder and Chief Executive of Hamilton Fraser, and a well-known expert in the cosmetic insurance sector with almost 30 years of experience. Under his leadership, Hamilton Fraser became the first company to offer medical malpractice insurance tailored to the aesthetics industry back in 1996.

Eddie's vision for the company has always centred on improving working standards within the company's chosen niche by providing relevant and innovative solutions to the management of risk, claims and complaint management.

Regularly providing education, support and advice at various trade events throughout the UK and sitting on several industry specific forums and bodies, Eddie helps to raise professionalism and standards.

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