sofw journal
Home & Personal Care Ingredients & Formulations
powered by SOFW

New Data on Topical Peptide for Needle-free Facial Remodeling

M. Gempeler, S. Dawson, R. Campiche

New Data on Topical Peptide for Needle-free Facial Remodeling

M. Gempeler, S. Dawson, R. Campiche

abstract

Hyaluronic acid (HA) or hyaluronan is a compound found in skin which is crucial to the smooth and full appearance of the face. It is frequently used as a filler injection in the cosmetic surgery industry. Since 2006, DSM Nutritional Products Ltd. (DSM) has known that its proprietary peptide molecule SYN®-HYCAN (INCI: Tetradecyl Aminobutyroylvalylaminobutyric Urea Trifluoroacetate) was effective in significantly upregulating hyaluronic acid expression within the skin itself. The aim of the research presented here was to make its demonstrated efficacy tangible and visible with novel technologies.

The data shows just how much this peptide boosts HA synthesis in dermal and epidermal cells *in vitro* and *ex vivo*. Moreover, thanks to cutting-edge 3D visualization technology and a novel, non-contact compression device, we can see how this compound significantly improves skin volume and restores firmness across multiple facial areas *in vivo*. Human feedback has also delivered useful results. Over 87 % of panelists reported that their skin felt supple and smooth and nearly 70 % confirmed that their skin had more elasticity.

DSM's peptide solution can therefore be used as an effective cosmetic alternative to dermal fillers or to enhance the effects of HA injections in between treatments.

It has never been easier to take control of our well-being and appearance. Medical beauty techniques offer an opportunity to achieve the looks we desire but this doesn't necessarily mean surgery. In 2017, minimally invasive treatments accounted for 80 % of plastic surgery procedures in the US [1] and consumers can now choose from a wide range of options, including filler injections, peels, and laser treatments. One of the most sought-after non-surgical procedures worldwide currently is cosmetic contouring, that is to say dermal fillers (see **Fig. 1**). According to a study from Market Research Future [2], the largest market for fillers is North America, but their popularity is growing rapidly in the Asia Pacific region and in Europe too.

The Rise and Rise of Hyaluronic Acid

Of the types of filler currently available, the most widely used is hyaluronic acid (HA). The American Society of Plastic Surgeons reports that 78 % of dermal filler procedures in the USA use HA [4]. Moreover, because of their natural-looking and reversible results, HA fillers are now the fastest growing non-invasive cosmetic treatment in the US [5]. HA is a very much in-vogue cosmetic ingredient too, with Google trend analytics from May 2018 reporting over 500,000 search results related to the term [6].

Hyaluronic acid is a naturally occurring substance in humans. 50 % of the body's HA is in the skin, where it is one of the Extracellular Matrix (ECM) molecules and the predominant component of the ECM. It is important for skin hydration – hyaluronic acid's tremendous water-binding capacity stems from the repulsion of charges in the sugar chain. Every second sugar in the molecule is charged. The repulsion force is lessened by binding water: The same principle is applied in the polymers used for diapers.

However, hyaluronic acid's principle role is in skin structuring and space filling. Dermal HA serves as a framework for structural proteins (e.g. collagen and elastin) and skin cells. With age, HA in the dermis decreases, causing facial skin to lose

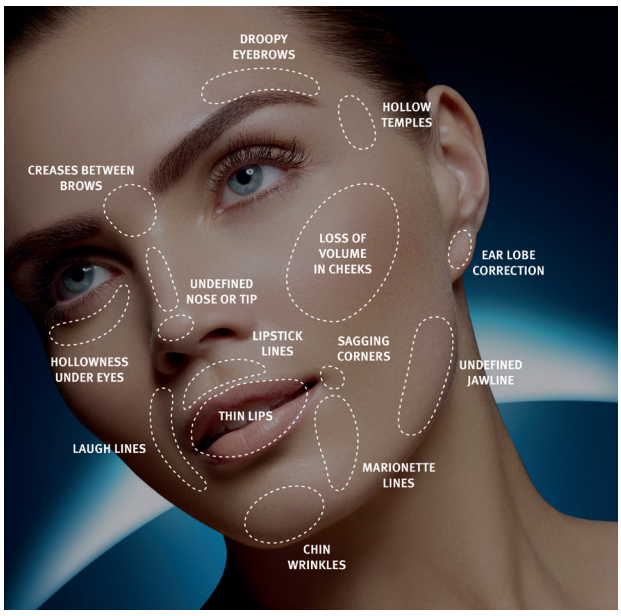


Fig. 1 Different facial zones that can be augmented by dermal fillers [3].

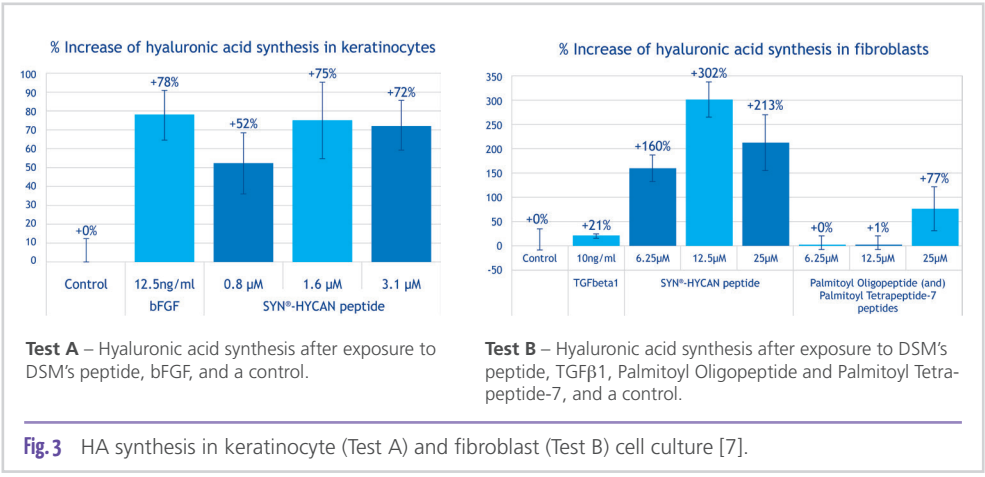
volume in key areas including the cheeks, under the eyes, the jawline, and around the mouth.

Boosting HA with Peptides

DSM's long-established peptide ingredient was developed to remodel, lift, and volumize facial skin by stimulating the body's own production of hyaluronic acid. The innovative solution boosts what the body itself produces by mimicking thrombospondin-1 (TSP-1), a signaling protein which activates transforming growth factor TGFβ1. This leads to increased HA synthesis, and thus to more dermal volume and a hydrated epidermis (see **Fig. 2**).

When it comes to compounds for topical application, the shorter the molecular chain, the more effective they are. Topical long-chain HA as it naturally occurs has only superficial efficacy as a humectant because it cannot permeate the skin barrier, its chain length being similar in size to that of the skin (2–3 mDa). Short-chain HA is a good humectant, but its permeation is limited. Ultra-short-chain HA is able to penetrate into the skin a little better but its viability in topical applications is negated by its relative costliness.

For this reason, DSM focuses its research on synthetic peptides. These peptides enable the development of tailor-made molecules using a rational design approach. Initially, molecules are modeled virtually to identify the most promising lead compounds. Based on these *in silico* results, a library of active compounds is then synthesized and tested to narrow the selection to those which are most effective. Owing to their intricately mapped design, peptides synthesized in this way come with a safety dossier and have a high degree of purity and stability without the need for preservatives. DSM's injection-free anti-wrinkle and anti-aging peptide promotes fuller, firmer skin and brings scientifically proven volumizing and firming benefits for all key facial zones.



Test A – Hyaluronic acid synthesis after exposure to DSM's peptide, bFGF, and a control.

Test B – Hyaluronic acid synthesis after exposure to DSM's peptide, TGFβ1, Palmitoyl Oligopeptide and Palmitoyl Tetrapeptide-7, and a control.

Fig. 3 HA synthesis in keratinocyte (Test A) and fibroblast (Test B) cell culture [7].

In vitro Studies

In the first study, hyaluronic acid synthesis was measured in keratinocytes after exposure to DSM's peptide, bFGF, and a control in Test A. bFGF is basic Fibroblast Growth Factor, a positive stimulator of hyaluronan in skin, both in fibroblasts and in keratinocytes. In Test B, hyaluronic acid synthesis was measured in dermal fibroblasts after exposure to DSM's peptide, normal TGFβ1, Palmitoyl Oligopeptide and Palmitoyl Tetrapeptide-7 (commonly used in skincare formulations), and a control. Hyaluronan concentration in the medium was measured using the Hyaluronan Assay Kit from Echelon (Salt Lake City, UT). DSM's peptide was shown to boost hyaluronic acid synthesis in dermal and epidermal cells *in vitro* (see **Fig. 3**).

DSM's proprietary peptide was also proven to bolster collagen organization and support by increasing lumican and decorin levels *in vitro*. These two ECM proteins strengthen collagen fibers and improve their structure. In Test C, normal human fibroblasts were incubated without FCS for 3 days. They were treated with DSM's peptide, regular TGFβ1, and a control. Biosynthesis of lumican and decorin was then measured using enzyme linked immunoassay (see **Fig. 4**).

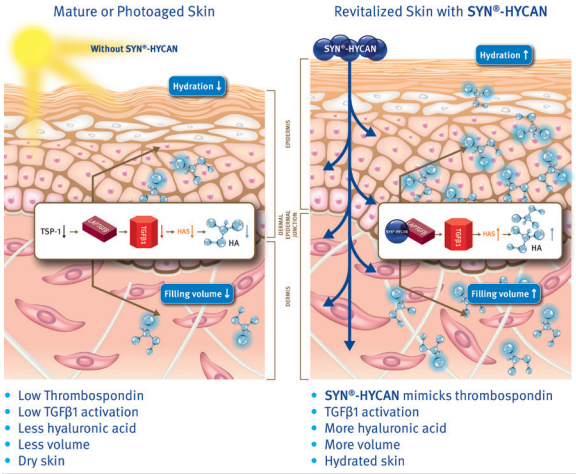
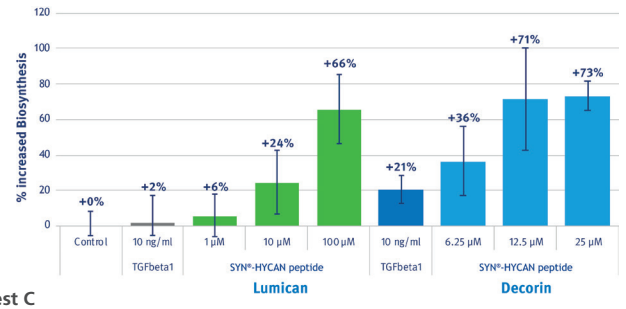


Fig. 2 Mimicking TGFβ1 activation for increased HA synthesis.



Test C

Fig. 4 Test C – increase in biosynthesis (%) after treatment with DSM's peptide, regular TGFβ1, and a control [7].

New *ex vivo* Study

In this study, skin tissue was incubated for six days having been treated topically with peptides. Hyaluronic acid was visualized by Alcian Blue staining. Alcian Blue (hyaluronic acid) was mainly detected in the papillary dermis, just below the dermal-epidermal junction (see **Fig. 5**). Semi-quantitative analysis was conducted using Image J software. The study showed an increased abundance of HA, demonstrating *ex vivo* that treatment with DSM's peptide boosts hyaluronic acid synthesis (see **Fig. 6**).

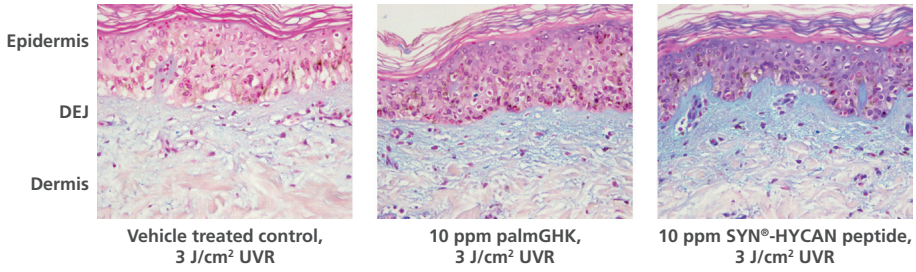


Fig. 5 Visible increase in hyaluronic acid *ex vivo* (blue staining). UVR = UV radiation.

New *in vivo* Studies

New studies have provided a wealth of new data that have helped to visualize key research and make it more tangible to DSM's customers, and their customers and the general public in turn.

The first of these studies was conducted using AEVA-HE, a trademark of Eotech, France. The study highlights the skin firming and remodeling properties of DSM's peptide in a positive volume assessment. It made use of specialist high-resolution 3D imaging cameras and software to measure skin topography, face topology, and body morphology changes. From the captured image of the 3D structure, the parameter 'positive volume' was measured at various points of the face. A positive volume indicates a filling effect, where the facial area is fuller at the final test point versus the beginning of the study.

The study involved a twice daily application for 1 month of a base formulation with or without a 2.5 % concentration of DSM's peptide on the full face. Caucasian female volunteers (30 per group) were between the ages of 41 and 60 with visible skin sagging on the face. The study was double-blind, placebo-controlled, and randomized, with the groups run in parallel. Measurement of skin distance change was carried out on multiple facial sites (**Fig. 7**).

Treatment with DSM's custom designed peptide produced a significant improvement in terms of skin volume compared with treatment with the base formulation alone.

Skin firmness among those groups was then assessed using Eotech's DynaSKIN technology. Like the 3D imaging cameras used in the study above, the machinery used here was cutting edge and enabled visualization of the data like never before. No contact was required with the study participants, which ensured that the procedure was as non-invasive as possible.

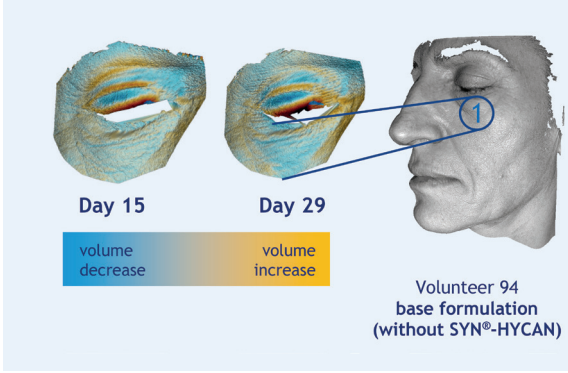


Fig. 7a 3D imaging showing skin volume change over time (base formulation without SYN®-HYCAN).

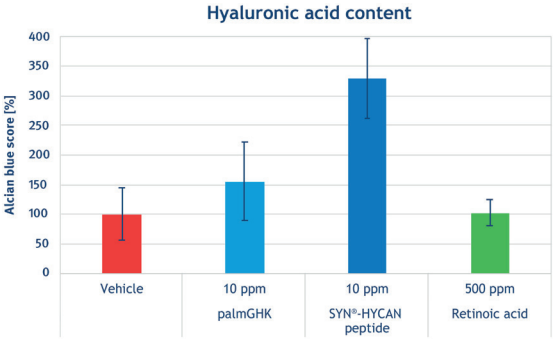


Fig. 6 Semi-quantitative analysis using Image J software. *p<0.05 vs vehicle by paired Student's t-test.

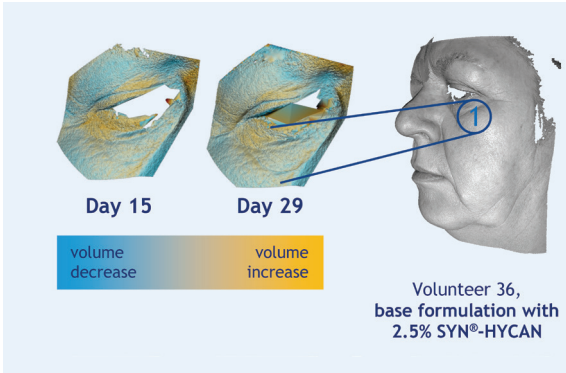


Fig. 7b 3D imaging showing skin volume change over time (base formulation with 2.5 % SYN®-HYCAN).

As **Fig. 8** shows, treatment with the peptide from DSM restores firmness of the skin.
The study participants could feel the benefits when surveyed for self-assessment feedback, with 90 % reporting a feeling of suppleness and 87 % communicating an increase in smoothness. 78 % of the participants responded that the product provides the skin with more moisture, while 63 % noted more elasticity and an overall healthier look.

An Injection-free Way to Firmer Facial Skin

DSM's product can be used for inspired cosmetics, providing smart, non-invasive TGFβ1 activation with proven increased HA synthesis. This has been proven to boost skin firmness and supports the new claim of a "volumizing" effect for the skin, outperforming the competition. Skin filling and firming is multi-zonal and improvements are noticeable in as little as four weeks.
Formulation is recommended at 2.5 % for firming and volumizing skin care, regenerative night care, anti-aging, anti-sagging, and skin moisturizing products. The peptide shows good compatibility with raw materials, is unpreserved, colorless, and odorless. It can be incorporated into the aqueous phase of a cosmetic formulation and can be processed either warm (for maximum 2 hours at 80 °C) or cold.

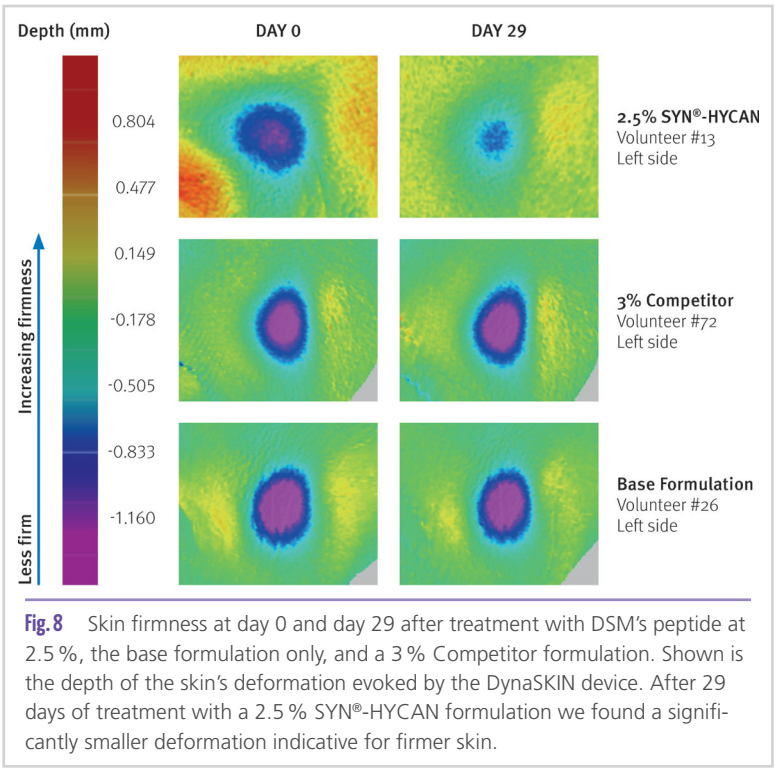


Fig. 8 Skin firmness at day 0 and day 29 after treatment with DSM's peptide at 2.5 %, the base formulation only, and a 3 % Competitor formulation. Shown is the depth of the skin's deformation evoked by the DynaSKIN device. After 29 days of treatment with a 2.5 % SYN®-HYCAN formulation we found a significantly smaller deformation indicative for firmer skin.

References

[1] ASPS 2017 Plastic Surgery Statistics report. Available at https://www.plasticsurgery.org/documents/News/Statistics/2017/plastic-surgery-statistics-report-2017.pdf
[2] Crossroads Today, ABC News, "Worldwide Dermal Fillers Market Projected to Grow at CAGR ~12.5 %" Dermal Fillers Market Research Report - Global Forecast till 2023 https://www.marketresearchfuture.com/reports/dermal-fillers-market-3893
[3] https://www.evoyouthful.com
[4] ASPS 2017 Plastic Surgery Statistics report. Available at https://www.plasticsurgery.org/documents/News/Statistics/2017/plastic-surgery-statistics-report-2017.pdf
[5] SELF, "Facial Fillers and Injectables are the Biggest Trends in Plastic Surgery". Available at https://www.self.com/story/facial-fillers-cosmetic-injections-trend
[6] Google Trends May 2018 Popularity Index of Hyaluronic Acid
[7] *Heidl, M. and R. Gräub*, Nuovo tripeptide anti-età, Cosmetic Technology. 2010. p. 13-16.

contact

Dr. Mathias Gempeler | Head of Science and Promotion Skin Care
Sonia Dawson | Regional Marketing Manager
Dr. Remo Campiche | Study Director

DSM Nutritional Products Ltd.
Wurmisweg 576
4303 Kaiseraugst | Switzerland