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Short Communication

Ideal Sized Chitosan (Arche) as a multifunctional biomaterial in aesthetic treatment

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ABSTRACT

Background: Aesthetic procedures such as laser resurfacing, microneedling, and injectable treatments intentionally disrupt the skin barrier, increasing susceptibility to microbial colonization, inflammation, and delayed healing. Post-procedural care therefore requires biomaterials that provide antimicrobial protection while supporting controlled inflammation and tissue regeneration.

Observation: Chitosan, a naturally derived polysaccharide, exhibits a unique combination of antimicrobial activity, immunomodulatory effects, and wound-healing support. These properties are influenced by molecular weight, degree of deacetylation, and formulation, allowing chitosan to function as a barrier material, bioactive dressing, and drug-delivery platform in aesthetic settings. Due to its ultra-low molecular weight (below 600 Da), Ideal Size Chitosan

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(ISC) manufactured by Arche (Doum Inc., Korea) is topically effective, as it can penetrate the skin barrier to target deeper dermal layers and deliver enhanced bioactive effects.
Clinical relevance: In post-aesthetic care, chitosan-based films, hydrogels, and nanoparticles may reduce infection risk, modulate excessive inflammatory responses, and promote re-epithelialization. However, variability among chitosan formulations and limited procedure-specific clinical data remain important considerations.
Conclusion: This short communication highlights the rationale for using chitosan as a multifunctional biomaterial in aesthetic aftercare and underscores the need for standardized formulations and targeted clinical studies.

Introduction

Aesthetic procedures increasingly rely on controlled skin injury to achieve rejuvenation, contouring, and resurfacing effects. Techniques such as laser treatments, microneedling, and injectable interventions transiently compromise the epidermal barrier, creating a microenvironment vulnerable to microbial invasion, exaggerated inflammation, and delayed healing. Consequently, post-procedural care materials must provide antimicrobial protection while maintaining a physiological inflammatory response conducive to tissue repair. Chitosan has emerged as a promising biomaterial in this context due to its multifunctional biological properties.[1]

Key observation and clinical relevance

Chitosan demonstrates broad-spectrum antimicrobial activity through electrostatic interactions between its cationic amino groups and negatively charged microbial cell membranes, leading to membrane disruption and impaired microbial proliferation. This property is particularly relevant following aesthetic procedures, where the risk of infection is elevated despite minimally invasive techniques (Fig. 1).

Beyond antimicrobial effects, chitosan exerts immunomodulatory actions by influencing macrophage activation and cytokine release. Rather than indiscriminately suppressing inflammation, chitosan has been shown to support a balanced inflammatory response, which is essential for orderly wound healing. In aesthetic aftercare, this modulation may help reduce prolonged erythema, edema, and discomfort without impairing tissue regeneration.[2,3]

Chitosan also contributes directly to wound-healing processes by promoting hemostasis, supporting fibroblast proliferation, and facilitating re-epithelialization. Its film-forming capacity allows the creation of semi-occlusive dressings that maintain a moist wound environment while protecting the treated area. Importantly, the biological performance of chitosan varies according to molecular weight, degree of deacetylation, and formulation, underscoring the need for careful material selection in clinical use.[4]

Practical considerations in aesthetic practice

In aesthetic applications, chitosan is most commonly formulated as hydrogels, films, membranes, or nanoparticles. These formats may be applied following laser resurfacing, microneedling, or minor surgical procedures to support barrier restoration and reduce microbial burden. Chitosan-based delivery systems have also been explored for localized drug delivery, enhancing residence time on treated skin or scalp surfaces.

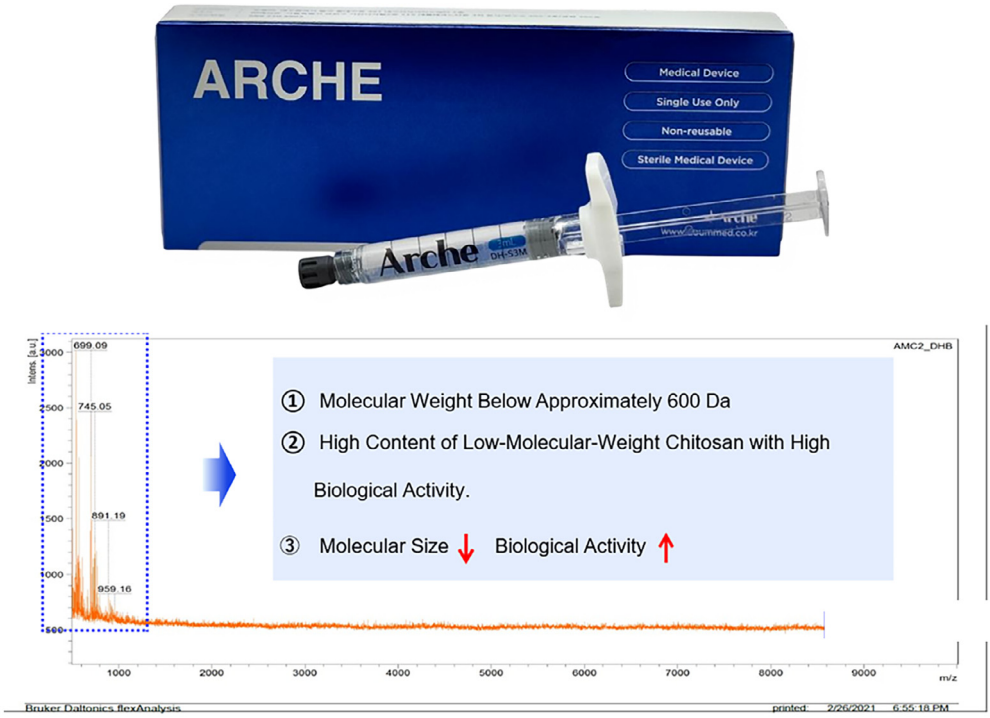

Figure 1. The MALDI-TOF analysis presented in the image confirms the critical molecular characteristics of Ideal Size Chitosan (ISC), specifically as manufactured by Arche (Doum Inc., Korea). The spectrum demonstrates a molecular weight distribution predominantly below approximately 600 Da, indicating a high content of low-molecular-weight chitosan. This is particularly significant because low-molecular-weight chitosan is associated with enhanced biological activity, including superior anti-inflammatory, antioxidant, and tissue-regenerating properties. Importantly, the reduced molecular size facilitates greater percutaneous absorption, enabling the chitosan to effectively bypass the stratum corneum barrier and target the deeper layers of the skin (dermis and hypodermis) when applied topically. Consequently, Arche's ISC technology optimizes the delivery of bioactive chitosan to the deep tissue compartments where collagen synthesis and extracellular matrix remodeling occur, thereby maximizing its therapeutic and aesthetic efficacy.

Ideal sized chitosan, particularly low-molecular-weight and water-dispersible chitosan fractions, is an attractive topical biomaterial for post-procedure skin care because it combines film-forming, bioadhesive, anti-inflammatory, antimicrobial, and wound-healing properties. In your lecture material, "ideal sized chitosan" is presented as a highly bioactive form intended to improve penetration, regenerative activity, and clinical tolerability. This concept is biologically reasonable because the host response to chitosan varies with molecular weight, and lower-molecular-weight preparations may behave differently from heavier membranes or gels.[5] From a pigmentary perspective, chitosan is especially interesting because experimental work has shown that it can suppress melanogenesis and also reduce melanosome transfer and uptake by keratinocytes. This means that chitosan may help limit post-inflammatory hyperpigmentation after procedures that trigger epidermal injury, including lasers and micro-poring techniques. The pigment-suppressive effect is promising, although it should be described cautiously because most of the evidence is still preclinical rather than based on large human trials.[6] Chitosan is also well suited to the immediate post-laser period, when the skin barrier is temporarily disrupted. After fractional photothermolysis, transepidermal water loss rises significantly, reflecting acute barrier damage; this is one reason why the skin feels hot, dry, and vulnerable after treatment, and why secondary problems such as folliculitis or viral reactivation can occur.[7] Because chitosan forms a thin, adherent, breathable film over the skin and has a long history as a wound-dressing polymer, topical application may help reduce evaporative water and heat loss after laser

treatment while maintaining a moist healing environment. Reviews of chitosan-based wound materials consistently describe faster re-epithelialization, lower inflammation, and lower infection risk, which supports its use as a barrier-restoring adjunct after energy-based procedures. This same logic applies to folliculitis prevention after invasive treatments such as fractional laser resurfacing or microporing. These procedures create microchannels or microthermal injury zones that temporarily weaken the epidermal barrier and disturb the local microbiologic environment. Chitosan's cationic surface interacts with negatively charged microbial membranes, giving it intrinsic antimicrobial activity, while its anti-inflammatory effects may calm the perifollicular response that often follows aggressive procedures. Therefore, topical chitosan may help reduce the chance of post-procedure folliculitis, especially in patients who are acne-prone, seborrheic, or easily inflamed. However, it is more accurate to say that chitosan is a biologically plausible preventive adjunct than a definitively proven standalone prophylactic treatment.[8] Finally, chitosan has meaningful relevance for acne treatment itself. Experimental studies have shown direct activity against *Cutibacterium acnes*, and some oligochitosan fractions demonstrated particularly strong antibacterial effects, including 10 kDa material in one study. Additional work has shown antimicrobial and anti-inflammatory activity in chitosan-based nanoparticle systems designed for cutaneous use. Together with its barrier-supporting and wound-healing effects, this makes ideal sized chitosan potentially useful not only for active acne, but also for recovery after acne procedures such as microneedling, laser toning, or fractional resurfacing. In practical terms, ideal sized chitosan can be positioned as a multifunctional topical adjunct: it may reduce pigment rebound, support barrier repair, limit evaporative heat loss, decrease folliculitis risk, and improve the inflammatory and microbial components of acne.[9]

Despite these advantages, clinicians should recognize that chitosan is not a single standardized material. Variations in physicochemical properties can influence biocompatibility and clinical performance. Furthermore, robust, procedure-specific clinical trials in aesthetic medicine remain limited, and extrapolation from general wound-healing literature should be approached cautiously.

Limitations and future directions

Current evidence supporting chitosan use in aesthetic aftercare is largely derived from preclinical studies and non-aesthetic wound models. Future research should focus on standardized chitosan formulations and controlled clinical trials tailored to specific aesthetic procedures to clarify efficacy, safety, and optimal application protocols.

Conclusion

Chitosan represents a multifunctional biomaterial with antimicrobial, immunomodulatory, and wound-healing properties that align well with the needs of post-aesthetic procedural care. Standardization of formulations and targeted clinical evaluation will be essential to fully define its role in aesthetic practice.

Ethical statement

This article is based on previously published data and does not involve new studies involving human participants or animals.

Informed consent

No new human data were generated or analyzed in this study. Informed consent for publication is not applicable.

Data Availability Statement

Data are available from the corresponding author upon reasonable request.

Declaration of competing interest

The authors certify that no aspect of their current personal or professional situation might reasonably be expected to significantly affect their views on the subject presented.

CRediT authorship contribution statement

Kar Wai Alvin Lee: Writing – original draft. **Olena Sydorchuk:** Writing – review & editing. **Jong Keun Song:** Writing – original draft. **Han Earl Lee:** Writing – original draft. **Alyona Livanskaya:** Writing – original draft. **Nil Namthongton:** Writing – review & editing. **Putri Hendria Wardhani:** Writing – review & editing. **Ardhiah Iswanda Putri:** Writing – review & editing. **Kyu–Ho Yi:** Conceptualization, Visualization, Supervision.

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