Webinar Will Begin Momentarily

TODAY'S AGENDA:

- Welcome
- Speaker Introduction
- Presentation
- Q&A
- Closing

Orgain®

Professional Education Series

Support. Inform. Educate. Empower.

Collagen Peptides in Clinical Practice: Mechanisms, Evidence, and Applications for Skin, Joint, and Bone Health

WEBINAR HOST:

Keith Hine, MS, RD
VP of Healthcare, Sports & Professional Education
Orgain, LLC

WEBINAR PRESENTER:

Shiloah Kviatkovsky, Ph.D, CISSN
Assistant Professor, Department of Orthopaedics
University of Arkansas for Medical Sciences

Funding from non-CPE revenue for CPE planning, development, review, and/or presentation has been provided by Orgain, LLC. *The views expressed herein are those of the presenter and do not necessarily represent Orgain's views. The material herein is accurate as of the date it was presented and is for educational purposes only and is not intended to be medical advice. The material presented in this webinar, is not intended to be a substitute for professional medical advice, diagnosis, or treatment. You should seek the recommendation of a medical professional regarding a medical condition or treatment or before starting a new nutrition and/or health regimen.*

Collagen Peptides in Clinical Practice: Mechanisms, Evidence, and Applications for Skin, Joint, and Bone Health

Evidence-Based Applications for Healthcare Professionals

Presenter:
Shiloah Kviatkovsky, PhD, MS, CISSN

DISCLOSURES

Disclosures & Educational Framework

No Conflicts of Interest

This presentation is developed independently with no commercial sponsorship or financial relationships to disclose.

Grant/Research Support:

PB Leiner
Nestlé Health

- **Consultant:**

PB Leiner
Nestlé Health
Bonafide Health LLC

Evidence-Based Approach

Content is derived from peer-reviewed literature, systematic reviews, and randomized controlled trials published in scientific journals.

Clinical Application Focus

Information provided is intended for educational purposes to support evidence-based clinical decision-making in dietetic practice.

Disclaimer: This presentation does not constitute medical advice. Clinical decisions should be individualized based on patient assessment, current evidence, and professional judgment.

Why collagen peptides are relevant to HCPs

High patient demand + widespread use

Patients routinely ask about collagen for skin aging, joint pain/OA, bone health, and recovery.

Evidence exists—but is heterogeneous

Data span RCTs and meta-analyses with differences in formulation, dose, duration, and endpoints.

Dietitians translate evidence to practice

Role includes expectation-setting, dosing/timing guidance, safety/allergen counseling, and product advice.

Best positioned as an adjunct, not a replacement

Collagen peptides complement total protein adequacy, resistance training/rehab, and condition-specific care plans.

Common questions you'll hear

"Does collagen actually work?"

"How much should I take—and for how long?"

"Is one type better (type I vs type II)?"

"What's the difference between collagen and whey protein?"

Learning Objectives

01

Differentiate collagen structures and bioavailability

Distinguish between collagen types, native collagen, gelatin, and hydrolyzed collagen peptides, including their absorption characteristics and clinical implications.

02

Discuss potential mechanisms of action

Describe potential mechanisms of action by which collagen peptides may improve skin, joint, and bone health.

03

Evaluate clinical evidence across outcomes

Analyze the strength of evidence for collagen peptides in skin health, joint function, bone metabolism, and emerging applications in clinical populations.

04

Apply practical dosing and timing strategies

Implement evidence-based protocols for collagen peptide supplementation, including optimal dosing, timing relative to exercise, and combination with cofactors like vitamin C.

05

Counsel patients with realistic expectations

Apply practical, evidence-based recommendations when counseling patients about collagen.

TODAY'S JOURNEY

Agenda

01

Collagen 101 + Mechanisms of Action

Exploring collagen in the body, in supplement form, and potential pathways: likely more than one mechanism at work

02

Collagen and Skin

Understanding what's really happening at the cellular and tissue level

03

Joint Health Data

Clinical evidence for collagen peptides in joint function, pain management in OA, and tendon and ligament health

04

Bone Health Data

Research findings on collagen peptides and bone density, turnover, and strength

05

Additional Clinical Applications

Emerging research findings on collagen peptides and muscle, wound healing, and perioperative care

06

Summary and Ending Remarks

Overview of dosing strategies and clinical applications for HCPs

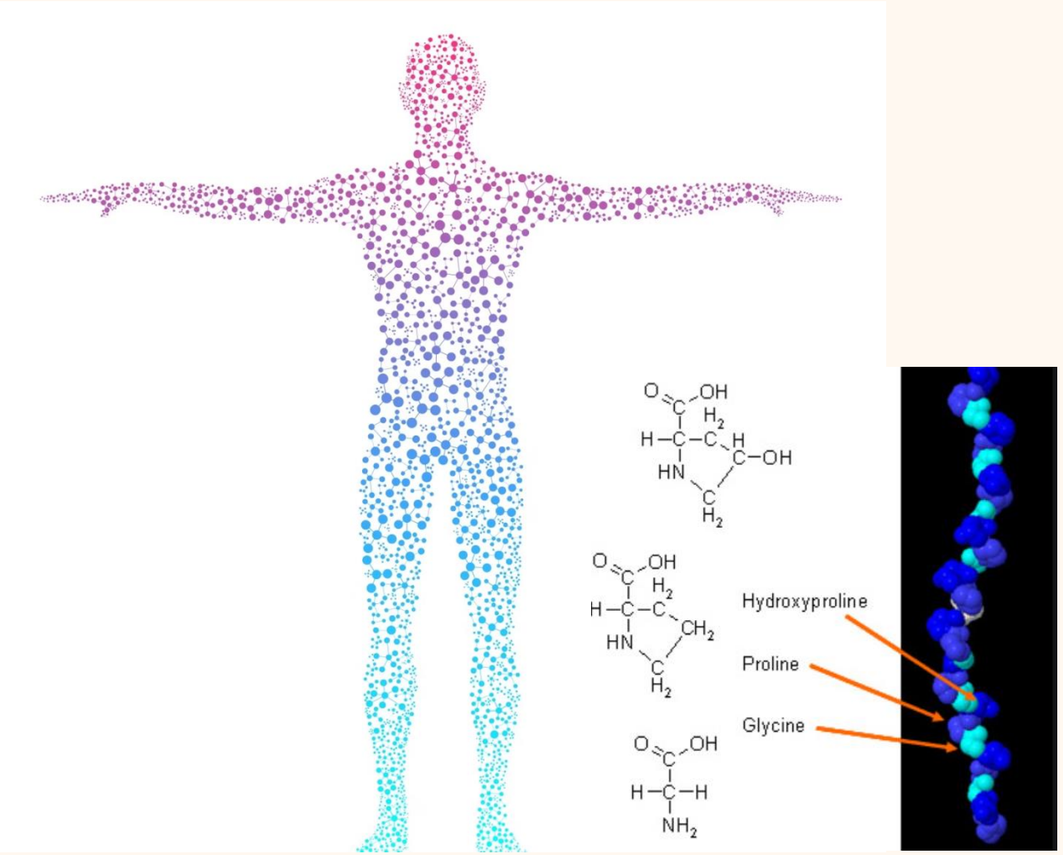
SECTION OVERVIEW

Collagen 101 + Mechanisms of Action

What is collagen and how does it work?

COLLAGEN 101

Understanding Collagen: The Body's Structural Protein



1/3

Total Body Protein

Collagen comprises one-third of the body's total protein content

70%

Skin Composition

The majority of skin's dry weight

80%

Tendons & Ligaments

Provides tensile strength and flexibility

30%

Bone Structure

Forms the organic matrix of bone tissue

> Collagen is the structural building block of our body

Collagen is also essential in eyes, ear and nose cartilage, teeth, hair, lungs, blood vessels, muscles, and the gastrointestinal tract.

Blum RS, 2011

Clinically Relevant Collagen Types

Over **28 collagen** types exist in the human body, but three dominate clinical applications based on tissue distribution and functional significance.

1

Type I Collagen

Location: Skin, bone, tendons, ligaments, cornea

Function: Provides tensile strength and structure; most abundant (90% of body collagen)

Clinical focus: Skin elasticity, bone density, wound healing

2

Type II Collagen

Location: Articular cartilage, intervertebral discs, vitreous humor

Function: Provides compressive resistance in cartilage

Clinical focus: Joint health, osteoarthritis management

3

Type III Collagen

Location: Skin, blood vessels, internal organs, reticular fibers

Function: Supports tissue architecture alongside Type I

Clinical focus: Skin structure, cardiovascular tissue integrity

Blum RS, 2011

COLLAGEN 101

Collagen Forms: Bioavailability & Clinical Application

1 | 2 | 3

Native/Whole Collagen

Structure: Intact triple helix, large molecular weight (300+ kDa)

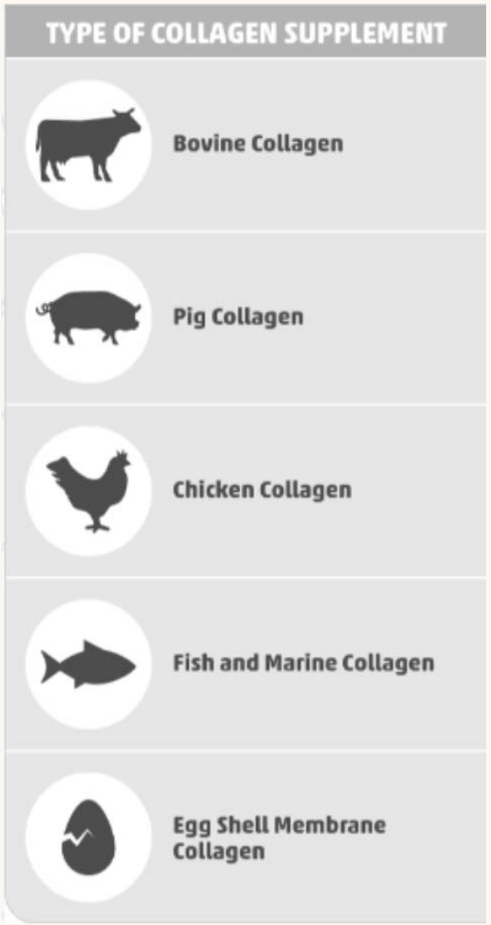
Absorption: Minimal intact absorption; requires extensive digestion

Clinical use: Food source only (bone broth, connective tissue)

Clinical Pearl: Hydrolyzed collagen peptides demonstrate superior absorption compared to gelatin or native collagen. Plasma concentrations of hydroxyproline-containing peptides peak 1-2 hours post-ingestion and remain elevated for up to 4 hours, supporting tissue accumulation.

Khatri M, et al. *Amino Acids.* 2021

Hydrolyzed Collagen Peptides



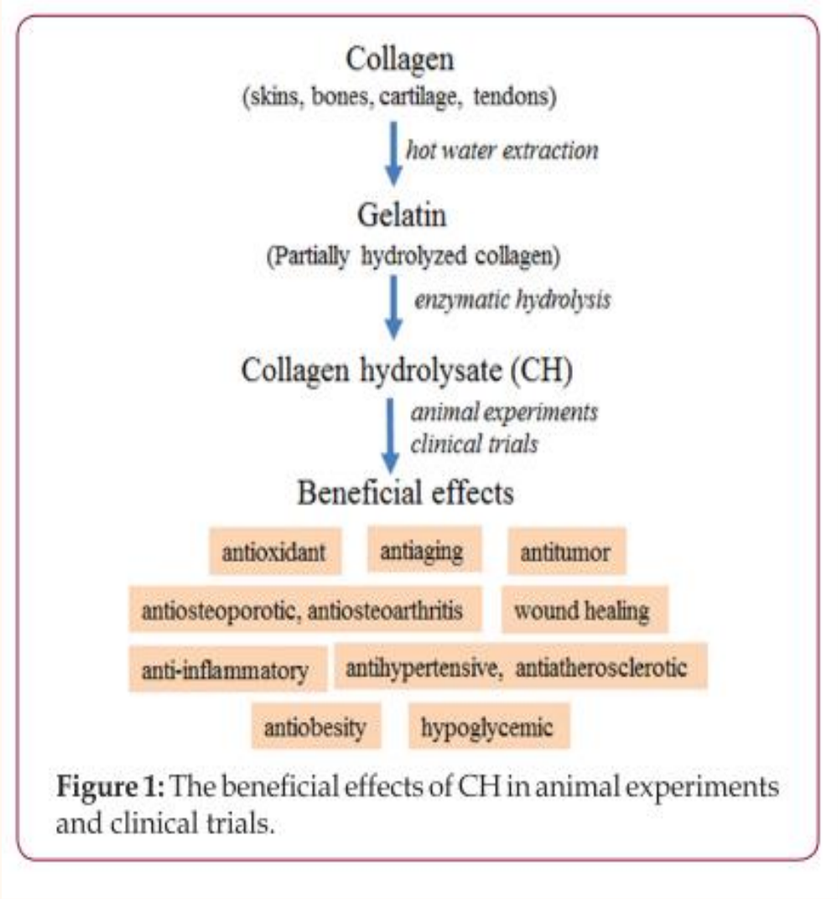
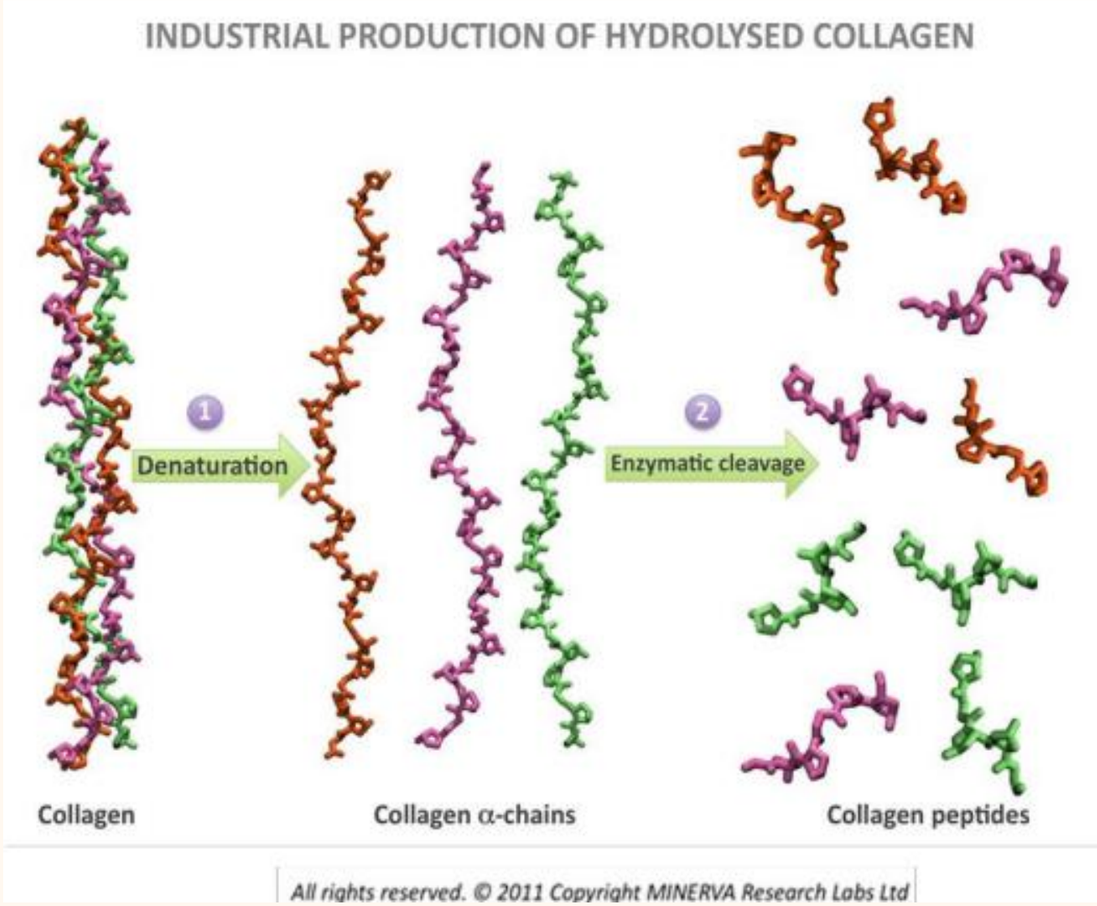


Figure 1: The beneficial effects of CH in animal experiments and clinical trials.



Sibilla et al., 2015; Song & Li, 2017

Absorption and Bioavailability: What the Evidence Shows

Collagen Stewardship Alliance fueled by INGREDIENT TRANSPARENCY CENTER

FACT

WE DON'T BREAK DOWN ALL PROTEIN INTO SINGLE AMINO ACIDS

- Like any protein, collagen can be digested into single amino acids, or into small peptide chains
- Collagen di- and tri-peptides often absorbed whole
- Event slightly longer chains of 20-50 amino acids (2k-5kDa) can remain intact … and be absorbed

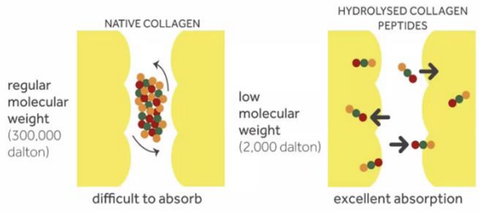
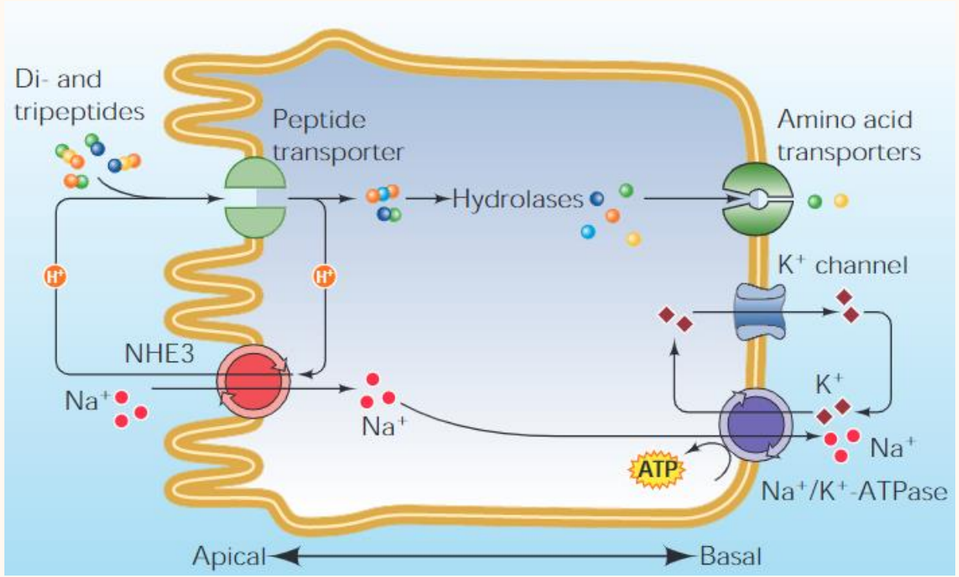


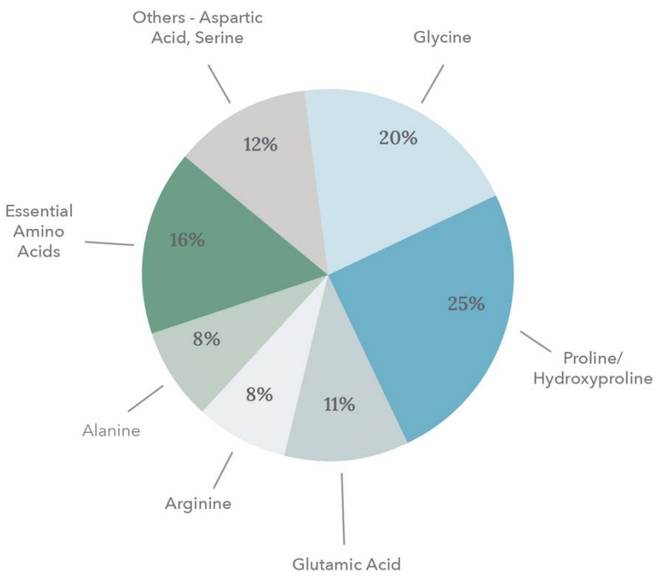
Image Credit: Absolute Collagen



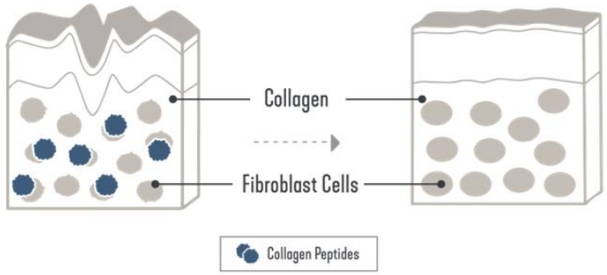
Skov et al., 2019; Daniel et al. 2006

Mechanisms of Action: 3 Hypotheses

1. A SUPPLY OF AMINO ACIDS



2. BIOLOGIC MESSENGERS



Collagen peptides stimulate activity of cells that produce new collagen and degrade old collagen fibrils:

Fibroblasts, Tenocytes, Chondrocytes and Osteoblasts

3. INDUCERS OF ORAL TOLERANCE

Oral Tolerance: Reduced immune response to previous antigens.

Collagen breakdown products in joints may serve as antigens.

Repeated ingestion of collagen peptides may “tolerize” the body to collagen, thus reducing the immune response in the joints.

*for undenatured type II collagen only

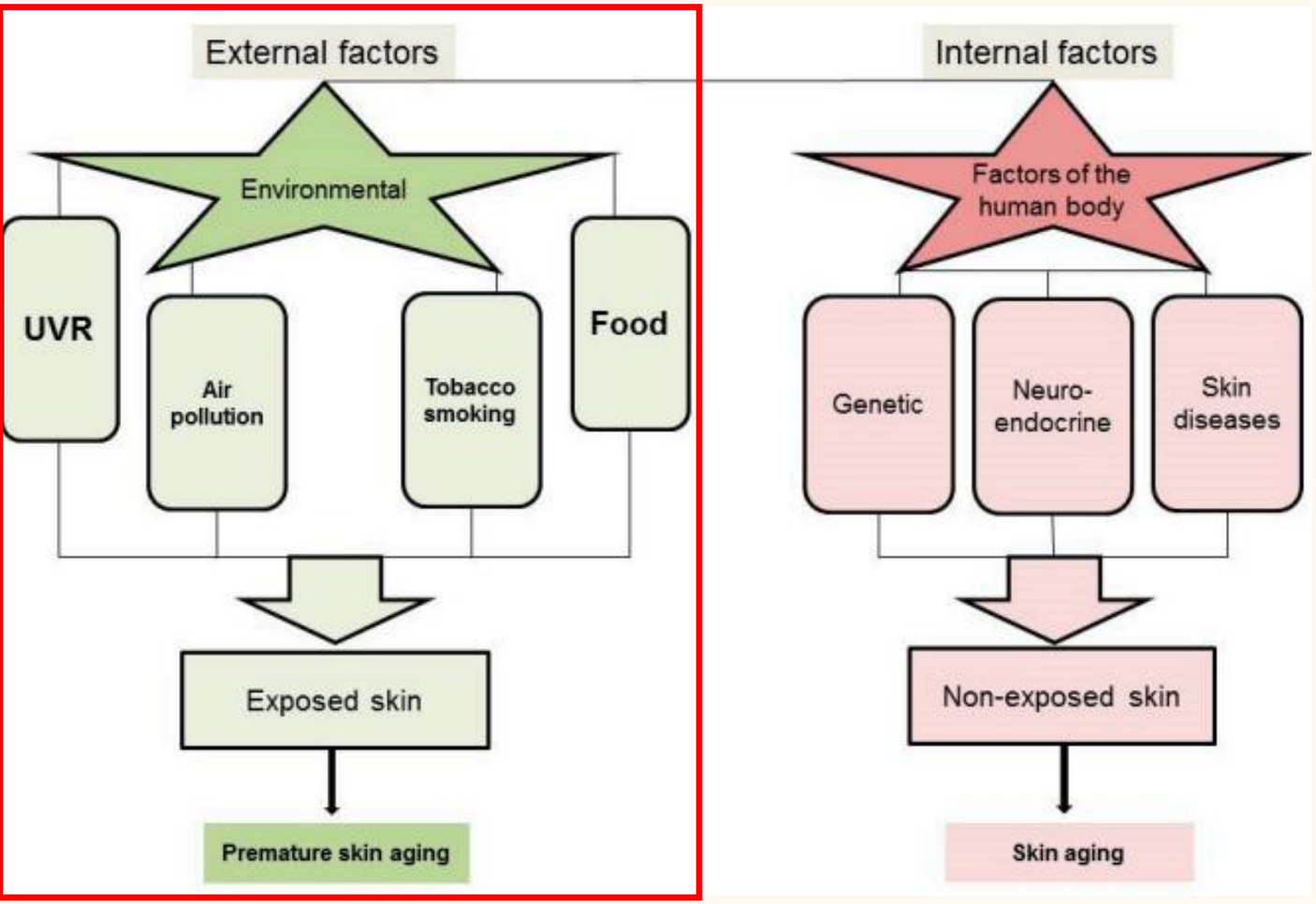
Khatri M, et al.,2021, Lugo JP, et al. 2016

CLINICAL EVIDENCE

Evidence — Skin

Hallmarks of skin damage

Loss of physiological function and structural integrity

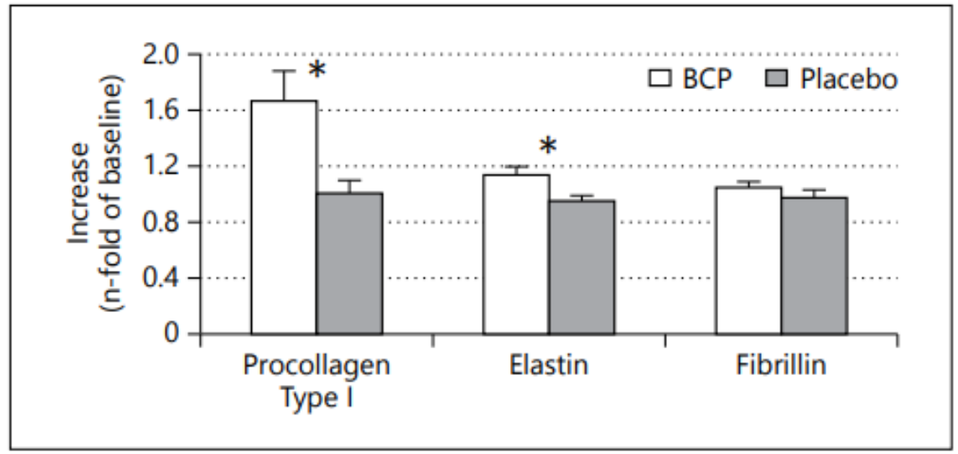


Kim et al. 2021; Bocheva et al. 2019

Collagen Peptides and Skin RCT

In a trial of women ages 45-65y (n=108)

- 2.5 g of collagen peptides vs. placebo
- 8 weeks
- Compared to the control group:
  - CP significantly reduced wrinkles ($p<.05$)
  - CP increased synthesis of skin procollagen type I by 65% and elastin by 18%



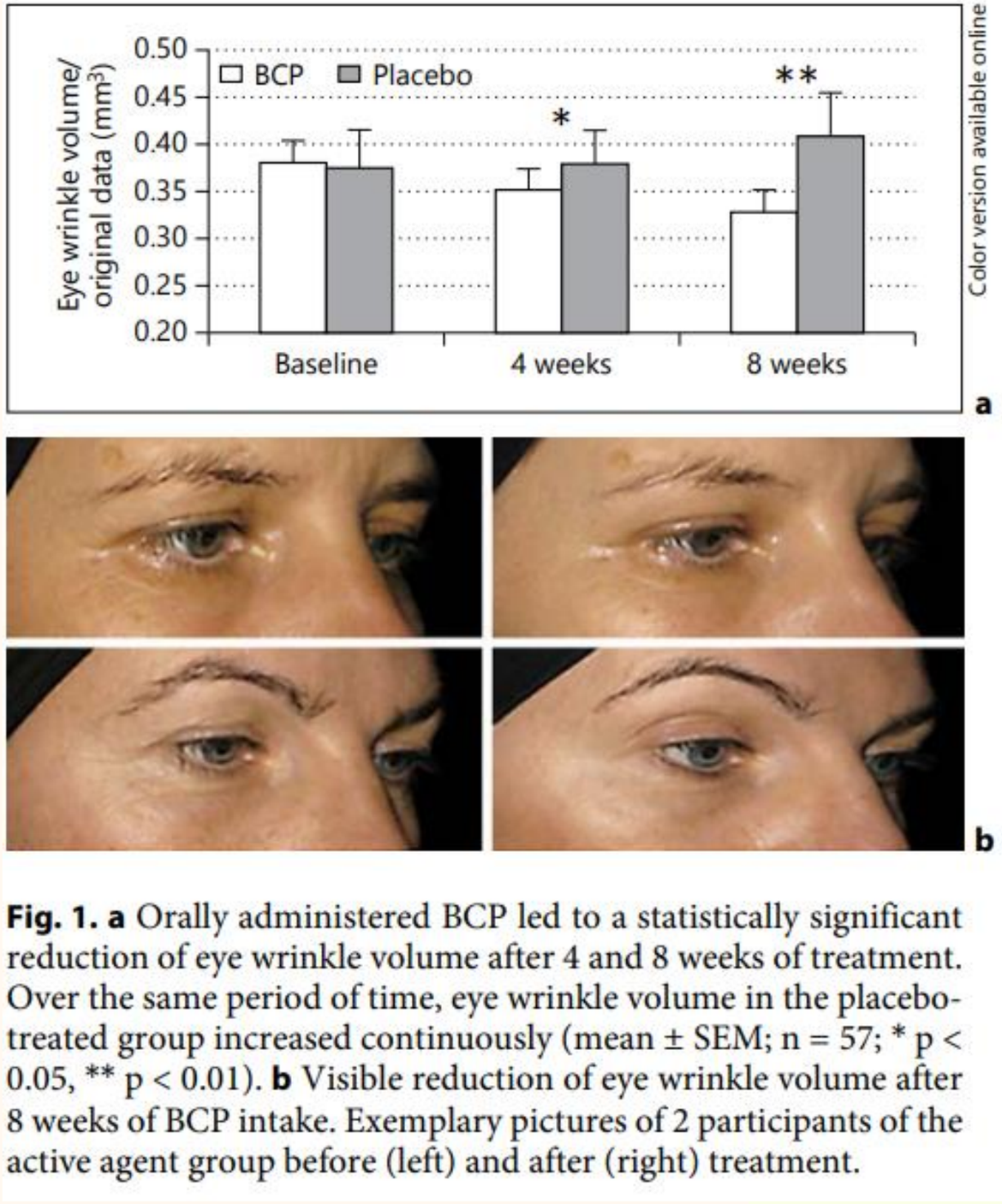
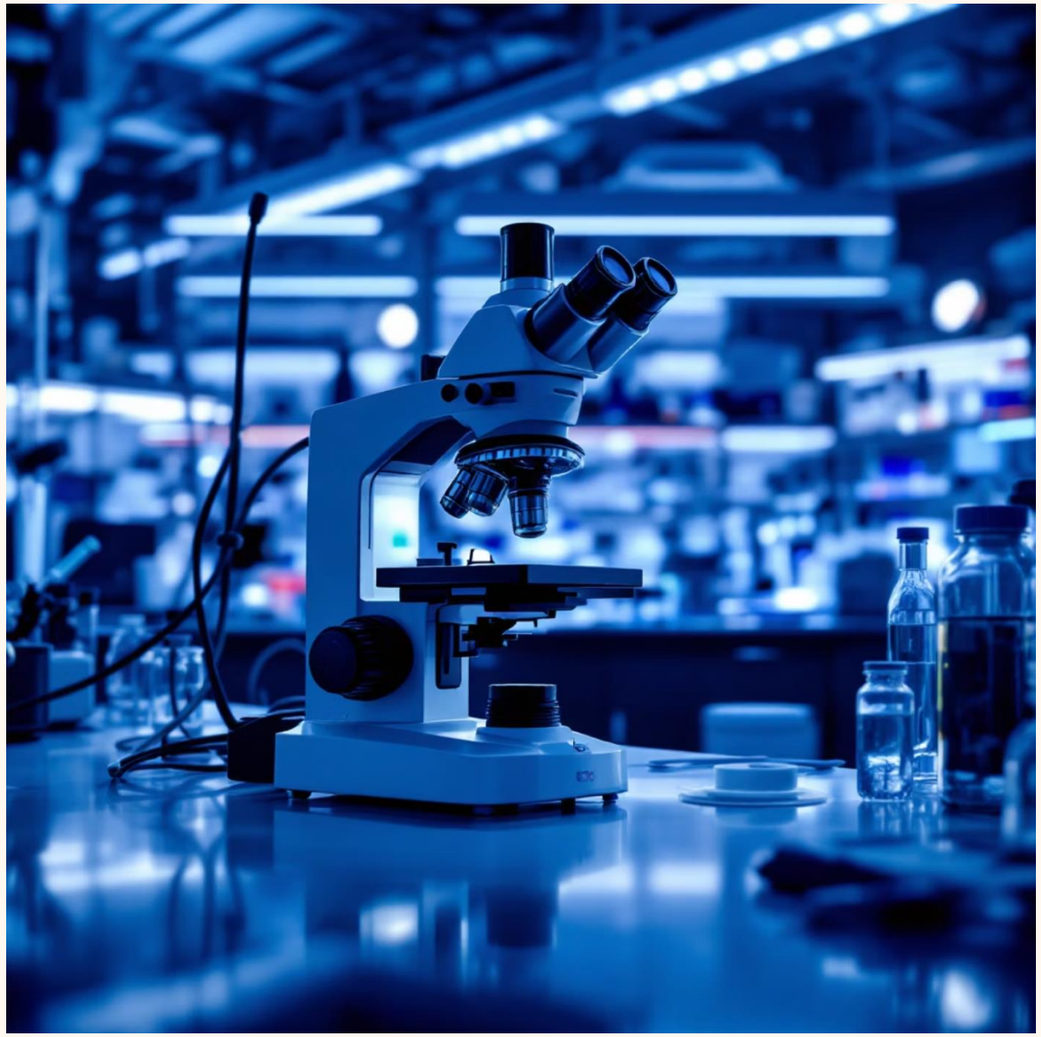


Fig. 1. a Orally administered BCP led to a statistically significant reduction of eye wrinkle volume after 4 and 8 weeks of treatment. Over the same period of time, eye wrinkle volume in the placebo-treated group increased continuously (mean ± SEM; n = 57; * $p < 0.05$, ** $p < 0.01$). **b** Visible reduction of eye wrinkle volume after 8 weeks of BCP intake. Exemplary pictures of 2 participants of the active agent group before (left) and after (right) treatment.

Proksch E. et al 2014

What the Systematic Reviews Show

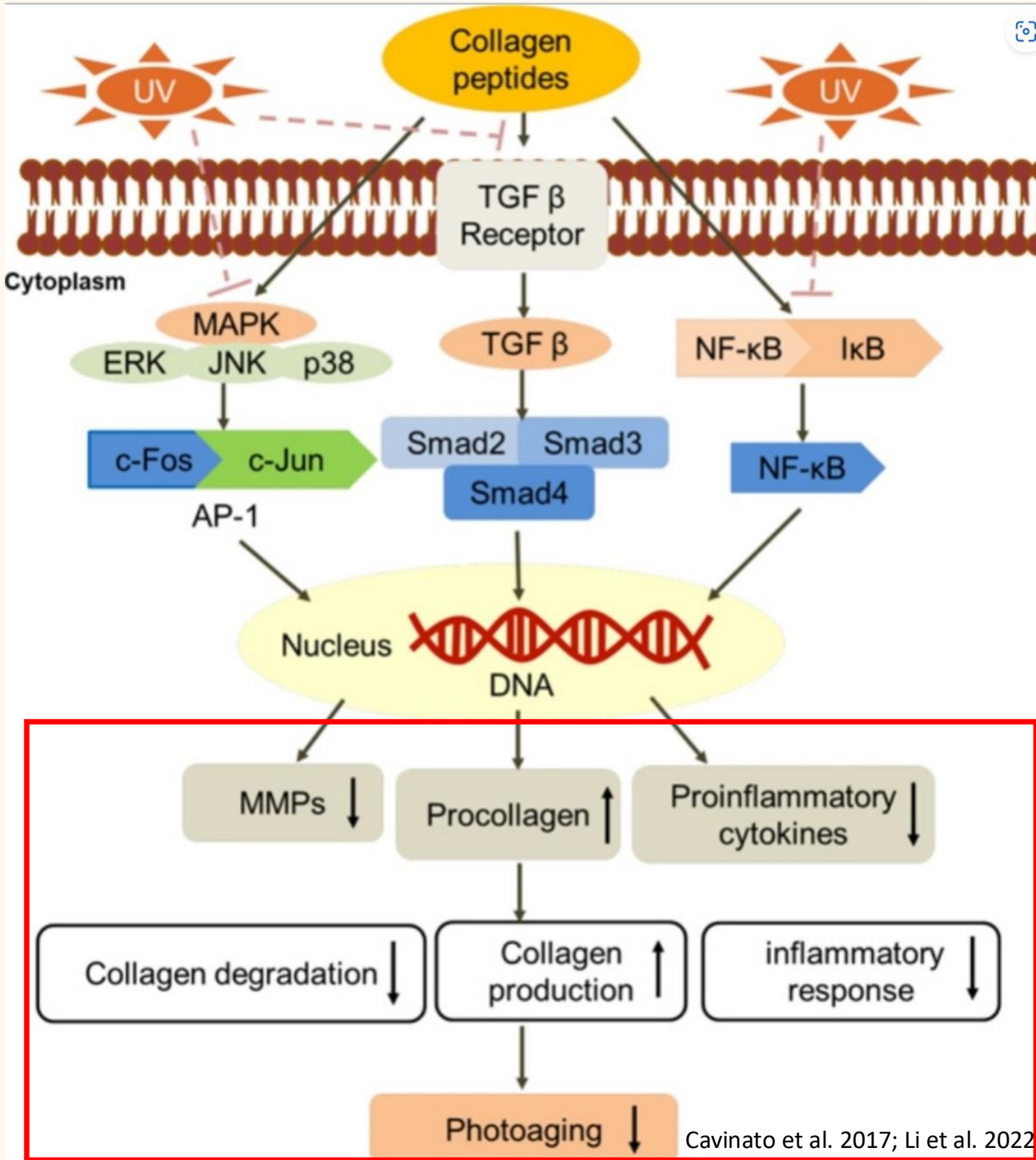


Meta-Analysis Conclusions

- **Hydration:** Significant improvement across multiple RCTs (SMD 0.4–0.8)
- **Elasticity:** Moderate but consistent gains, especially in women over 35
- **Wrinkles:** Visible reduction in eye area; effects stronger with longer supplementation
- **Safety:** Excellent tolerability profile; adverse events rare and mild
- **Funding bias:** Industry-funded trials show larger effects, but independent studies still demonstrate benefit

De Miranda RB, et al., 2021; Choi FD, et al., 2019

Collagen in Photoaging



Cavinato et al. 2017; Li et al. 2022

EVIDENCE: SKIN

Skin Health Outcomes: Clinical Evidence Summary

Primary Outcomes Demonstrated

- **Skin elasticity:** Significant improvements in elasticity measures (R2, R5, R7) after 8-12 weeks
- **Hydration:** Increased skin hydration and reduced transepidermal water loss
- **Wrinkle reduction:** Decreased wrinkle depth and improved skin surface structure
- **Dermal density:** Ultrasound and biopsy studies show increased dermal collagen density

2.5-15

Dose Range (grams/day)

Most studies use 2.5-10 g daily; lower doses effective for skin outcomes

8-12

Weeks to Visible Effects

Clinically meaningful changes typically observed by 8-12 weeks of consistent use

12

Studies in Meta-Analysis

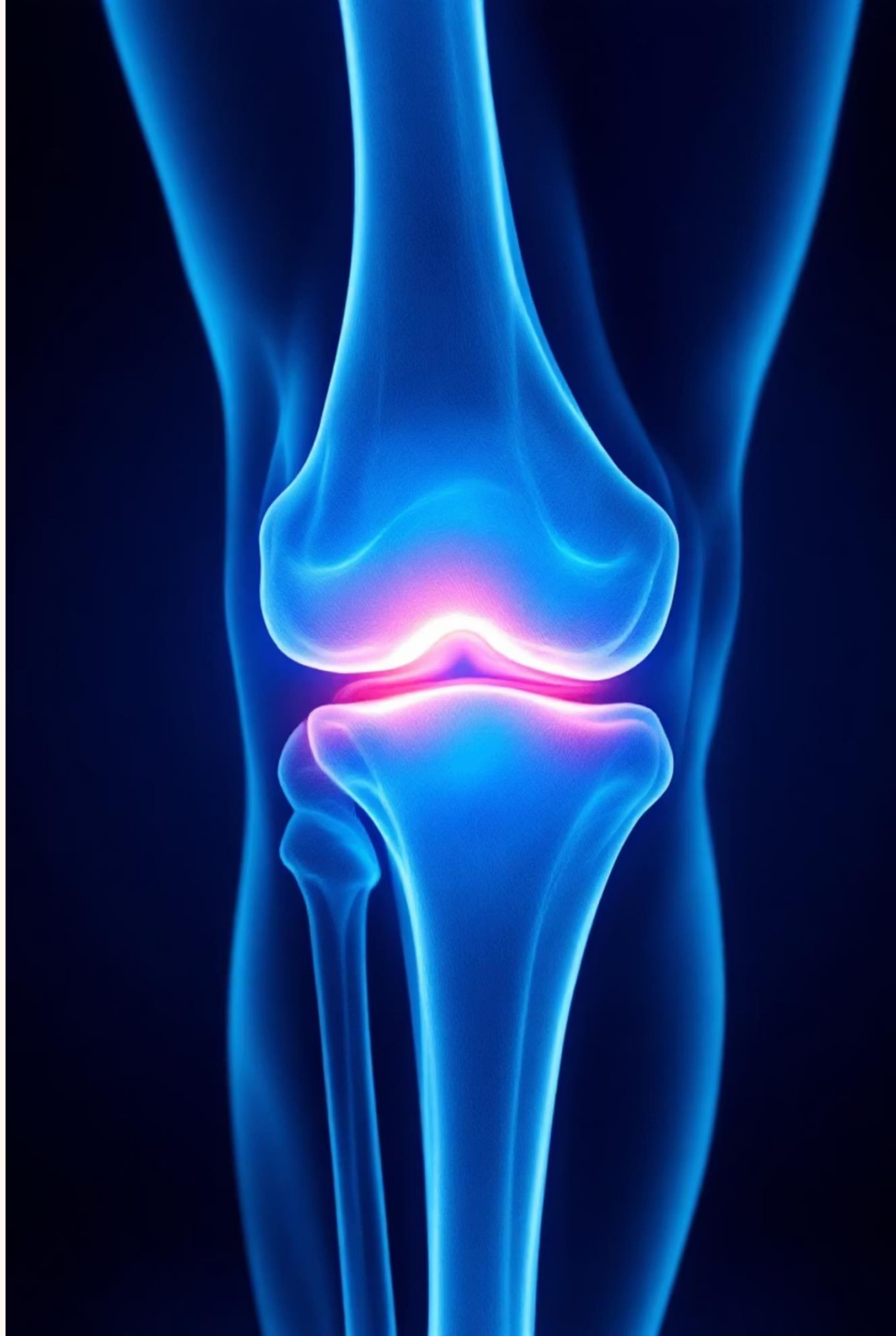
Systematic reviews include 12+ RCTs showing consistent benefits across populations

Who Benefits Most: Women ages 35-65, those with photoaged skin, individuals with reduced dietary protein or collagen intake. Effects more pronounced in older adults with baseline collagen decline.

Proksch E, et al., 2014; De Miranda RB, et al., 2021

CLINICAL EVIDENCE

Evidence — Joints/OA

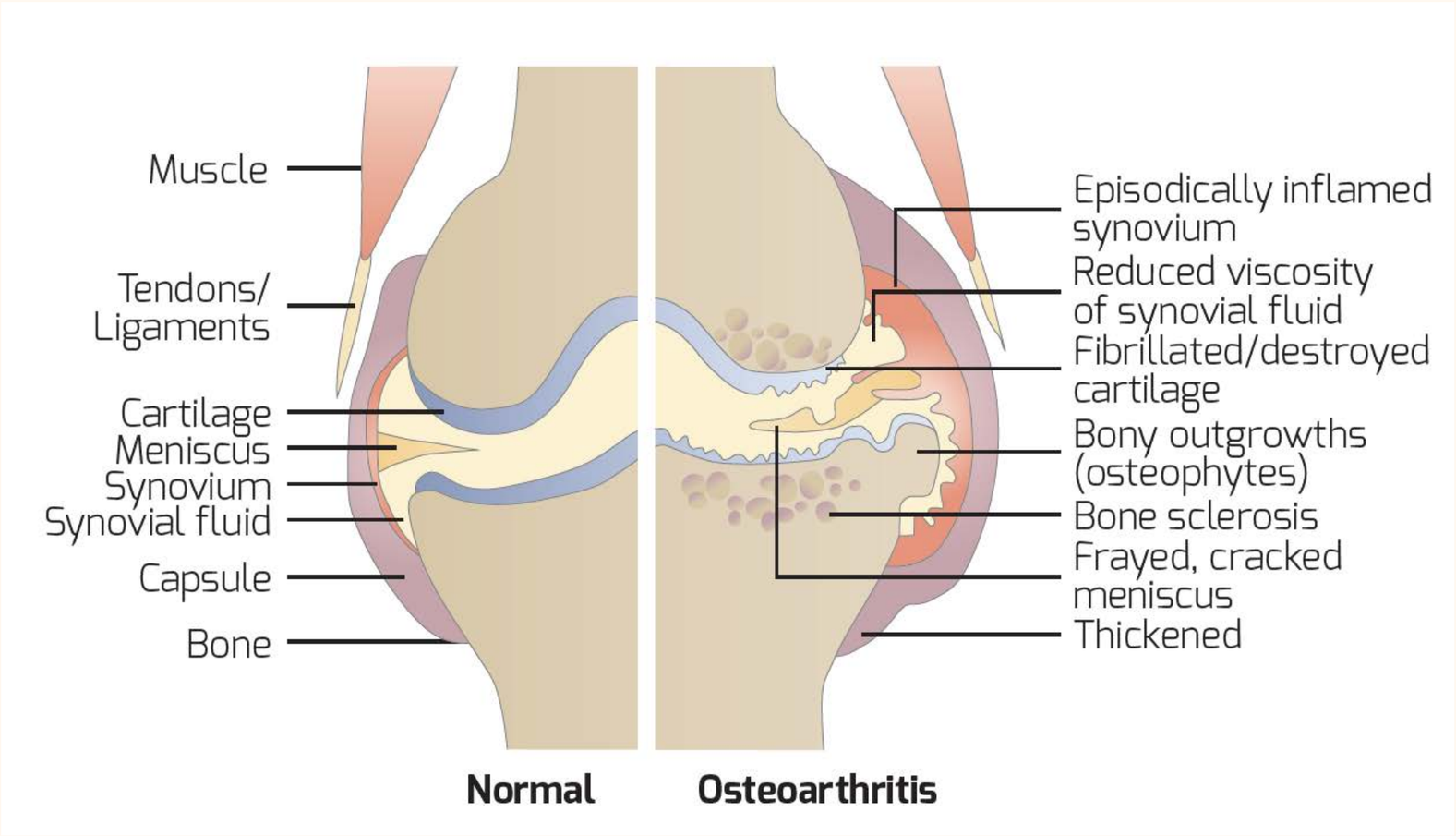


Joint Physiology

TWO CONTRIBUTORS TO JOINT PAIN:

Joints lose collagen and other matrix components that maintain structure and provide cushion between bones, joints and ligaments.

Joints produce inflammatory mediators, that lead to swelling stiffness and discomfort.



McAlindon et al. 2011

Recent RCT Spotlight: Low-Molecular-Weight Collagen

Park et al. 2025 — Key Findings

Design: 6-month RCT in knee OA patients (n=80) 40-75 yrs.

Intervention: 3 g/day low-molecular-weight collagen peptides vs. placebo

Primary outcome WOMAC pain and physical function subscales, as well as WOMAC total improved significantly. No serious adverse events.

Clinical takeaway: Low-MW peptides may enhance absorption and efficacy. Results align with broader meta-analysis trends.

Collagen Peptides vs. UC-II: Clinical Positioning

Collagen Peptides (Hydrolyzed)

- **Dose:** 5–10 g/day
- **Mechanism:** Provides amino acids (glycine, proline, hydroxyproline) for cartilage synthesis
- **Evidence:** Multiple RCTs and meta-analyses; moderate-quality evidence
- **Best for:** General joint health, athletes, mild-moderate OA

UC-II (Undenatured Type II Collagen)

- **Dose:** 40 mg/day
- **Mechanism:** Oral tolerance; modulates immune response in joint tissue
- **Evidence:** Smaller number of RCTs; promising but less meta-analysis data
- **Best for:** Moderate-severe OA, patients seeking lower-dose option

Both are safe and evidence-based. Choice depends on patient preference, cost, and OA severity. Not typically combined.

Lugo JP, et al., 2016; Liang CW, et al., 2024

Meta-Analysis Summary: Clinical Interpretation

Pain Reduction

Pooled analysis shows significant VAS score improvement (mean difference: −10 to −15 mm). Effect size comparable to low-dose NSAIDs in mild-moderate OA.

Functional Improvement

WOMAC physical function scores improve moderately. Patients report easier stair climbing, walking, and daily activities.

Safety Profile

Adverse events minimal. GI symptoms rare. No drug interactions reported. Well-tolerated long-term.

Evidence strongest for knee OA. Hand and hip OA data emerging but less robust. Heterogeneity exists across trials in dose and peptide type.

Liang CW, et al., 2024; Park SY, 2025

EVIDENCE: JOINTS

Joint Health: Osteoarthritis Pain & Function

Evidence Base for Collagen Peptides in OA

Multiple randomized controlled trials and systematic reviews support the use of collagen peptides for osteoarthritis symptom management. Evidence is strongest for knee OA, with emerging data for hip and hand joints.

1

Pain Reduction

Significant reduction in VAS and WOMAC pain scores compared to placebo. Effect size modest but clinically meaningful, particularly for mild-moderate OA.

2

Functional Improvement

Improvements in WOMAC function subscale, stair climbing ability, and joint mobility. Effects emerge gradually over 12-24 weeks.

3

Cartilage Biomarkers

Reduced CTX-II (cartilage degradation marker) and increased type II collagen synthesis markers suggest protective effects on cartilage metabolism.

Recommended Dosing

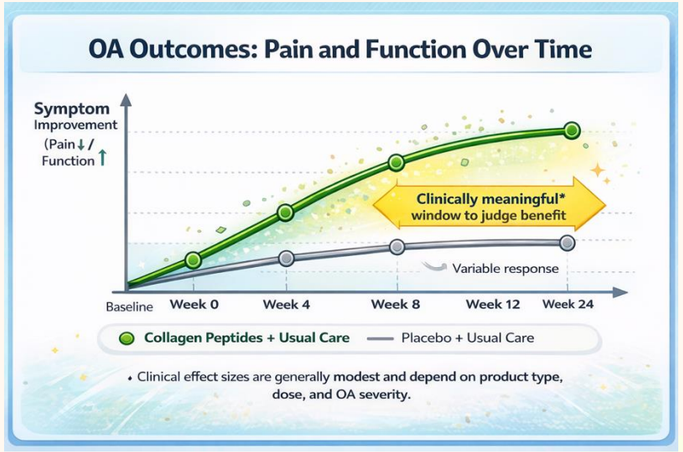
Standard dose: 10 g/day hydrolyzed collagen

Alternative: 40 mg/day undenatured type II collagen (UC-II) for immune-mediated mechanism

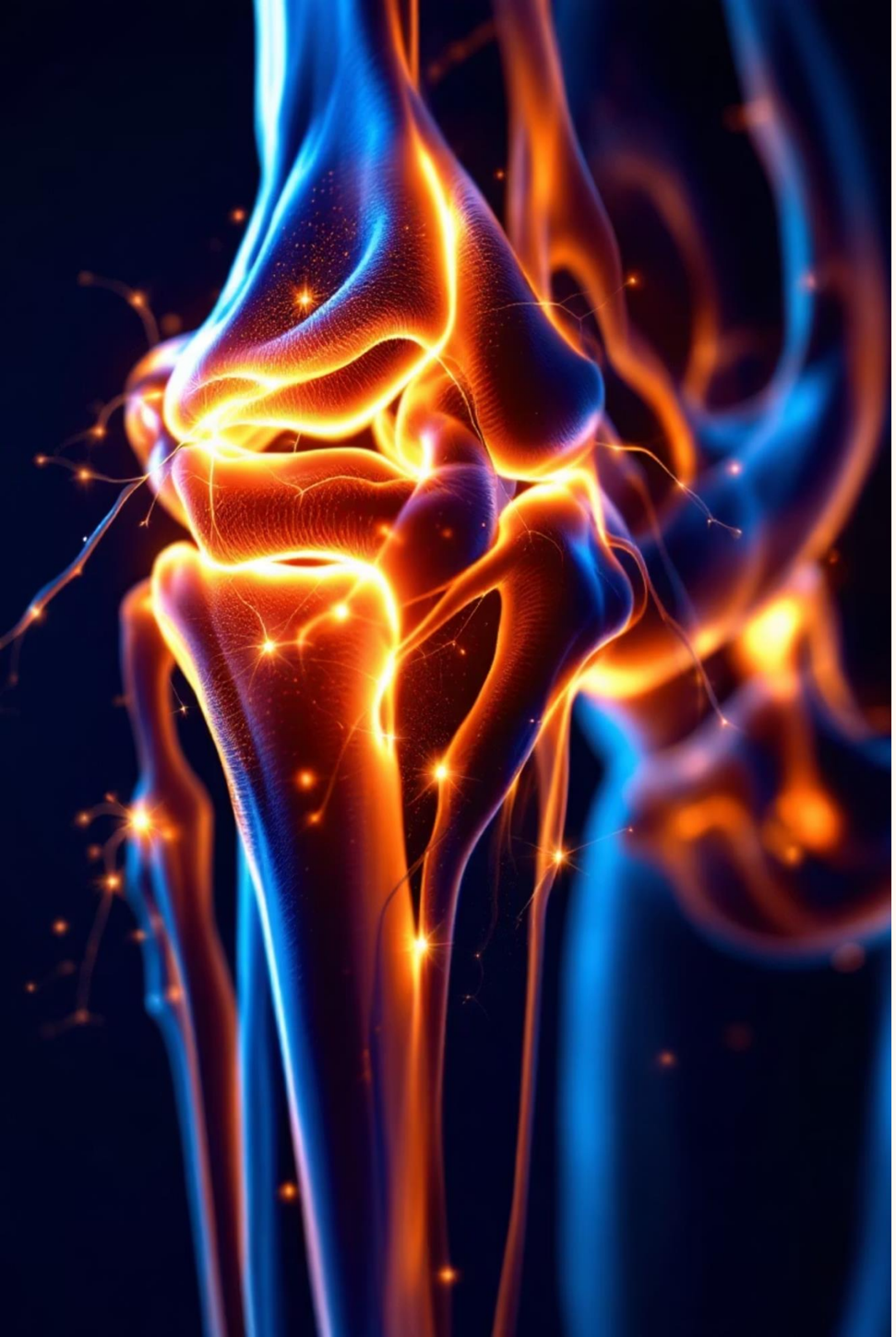
Duration: Minimum 12 weeks; optimal benefits at 24+ weeks

Clinical Positioning

Adjunctive therapy for OA management. Consider for patients seeking non-pharmacologic options, those with GI intolerance to NSAIDs, or as part of comprehensive joint health strategy.



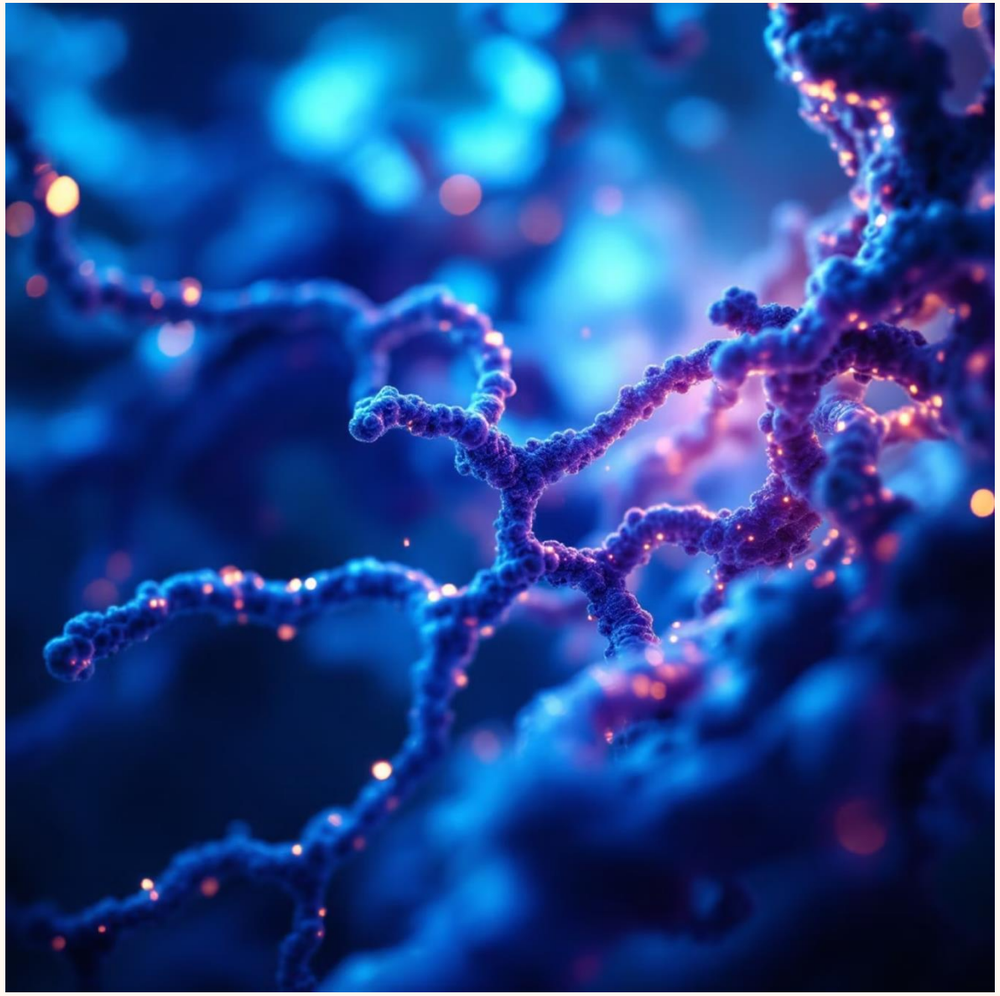
Liang CW, et al.. 2024



Joints — Tendon & Ligament

CONNECTIVE TISSUE SUPPORT

Key Evidence: Collagen Synthesis Boost



Shaw et al. 2017 Study

Landmark research demonstrated that 15 g gelatin (collagen source) plus vitamin C, taken 1 hour before 6 minutes of intermittent rope-skipping exercise, doubled collagen synthesis markers in serum.

Mechanism: Vitamin C is essential for hydroxylation of proline and lysine residues in collagen. Exercise provides mechanical signal. Together, they optimize collagen fibrillogenesis.

Clinical Implication: Strategic timing matters. This synergy model informs rehabilitation protocols and injury prevention strategies in athletic populations.

Loading Synergy: The Pre-Exercise Model

01

Collagen Timing

Consume 10–15 g collagen peptides or gelatin consumed **30–60 minutes before exercise** or rehabilitation activity (Shaw et al., 2017; Lis et al., 2019)

02

Mechanical Loading

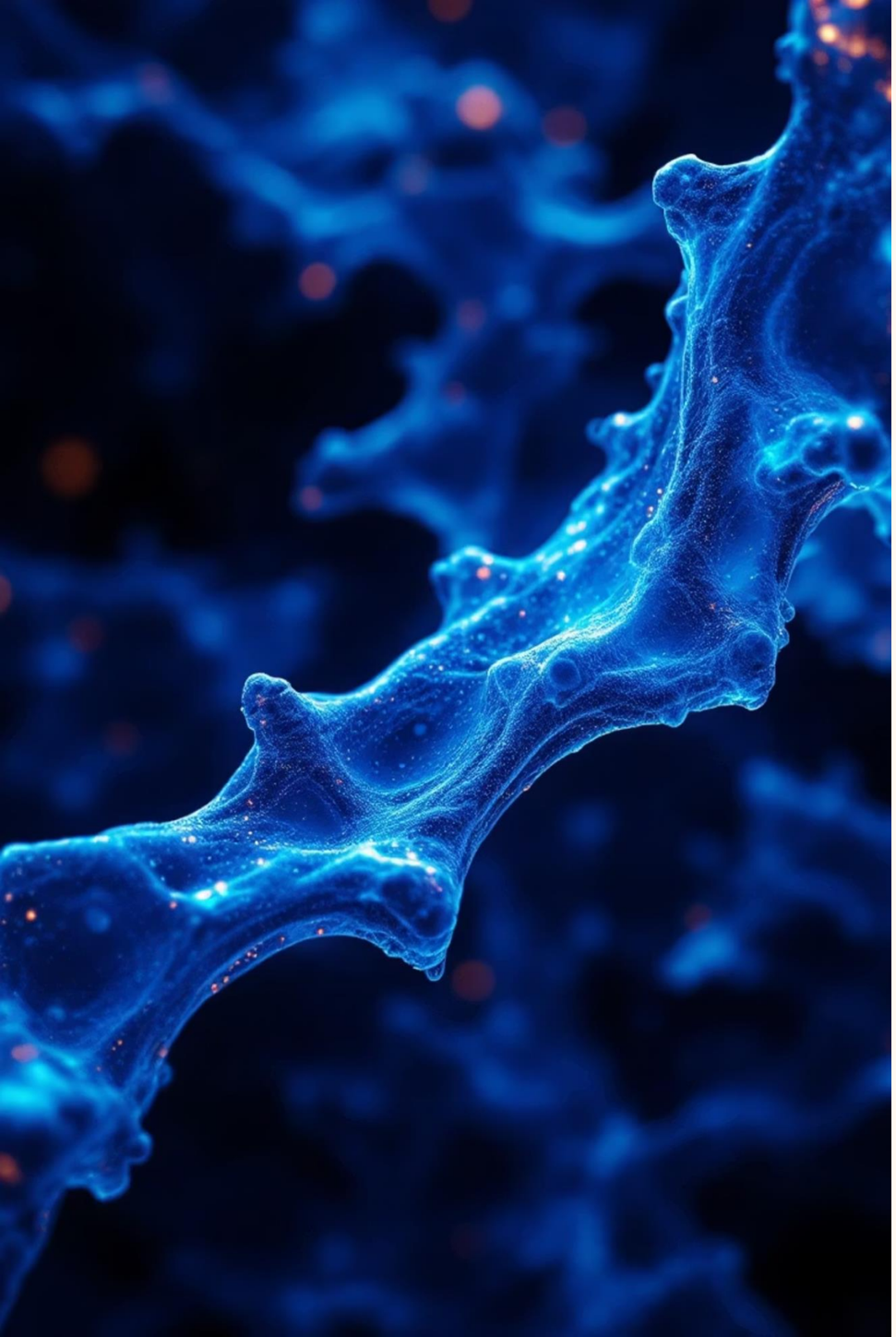
Exercise or rehab session provides mechanical stimulus to target tissues, enhancing collagen synthesis when combined with pre-exercise intake

03

Vitamin C Co-ingestion

50 mg vitamin C consumed with collagen. Essential cofactor for hydroxylation of proline residues during collagen synthesis (Shaw et al., 2017)

Emerging Strategy: This tripartite approach—pre-exercise collagen + vitamin C + loading—maximizes collagen synthesis in target tissues.



Evidence — Bone Health

CLINICAL APPLICATIONS

BONE COMPOSITION

MINERALS EMBEDDED IN A COLLAGEN MATRIX

- 50-70 % Mineral, hydroxyapatite crystal
- 20-40 % Organic Matrix (90% Type I collagen)
- 5-10 % Water
- Small amount of lipid

Amer Soc for Bone and Mineral Research, Primer, 1999

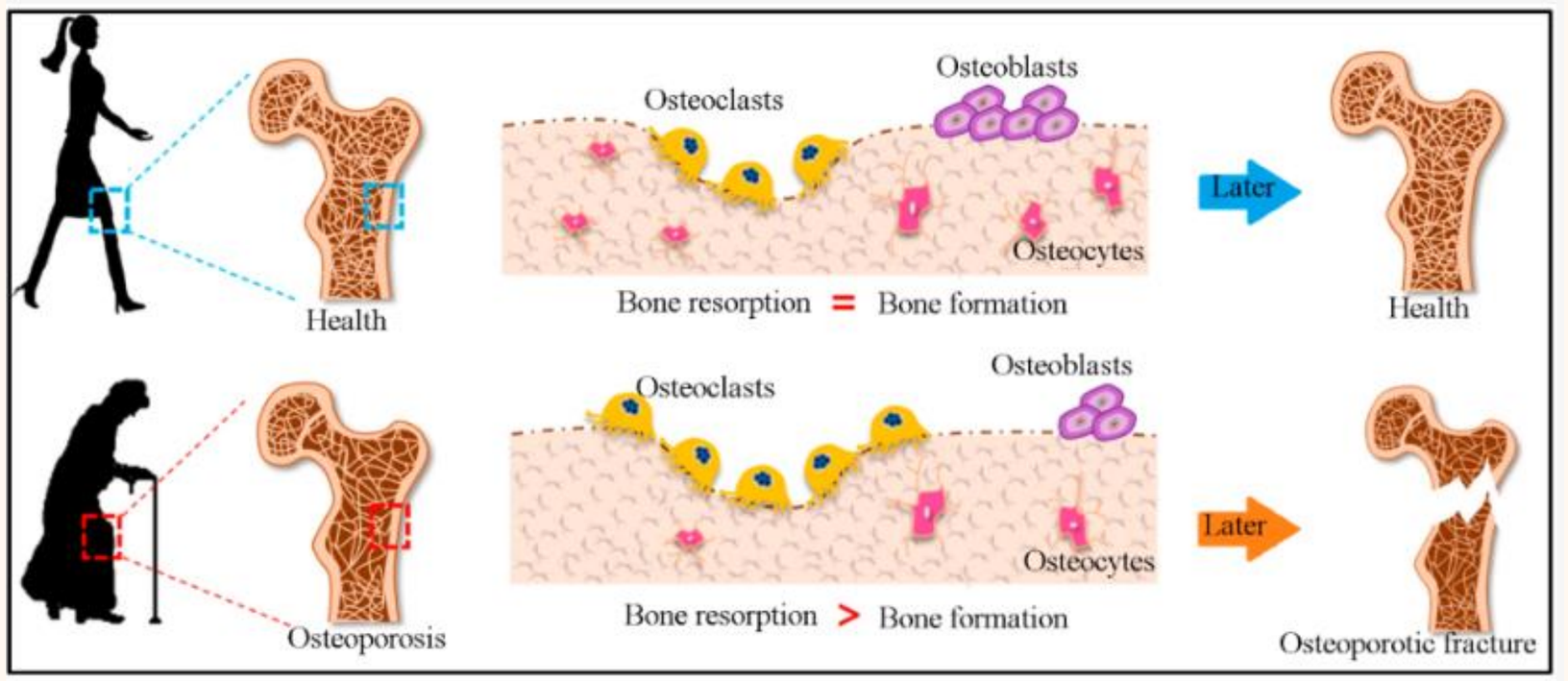
Bones and the Remodeling Process

OSTEOBLASTS are involved in bone formation and mineralization

OSTEOCLASTS are involved in bone breakdown or resorption.

BONE MINERALIZATION is the process where minerals are added to the organic matrix of bone.

BONE REMODELING (or bone metabolism) is a continuous process where mature bone tissue is removed from the skeleton (also called bone resorption) and new bone tissue is formed.



Rani et al., 2020

Key RCT: Postmenopausal Women

Dose

5 grams daily of specific collagen peptides (CP) for 12 months

BMD Outcomes

Significant increase in spine BMD (+2.3%) vs. placebo; favorable trend in femoral neck

Marker Changes

P1NP increased (formation), CTX decreased (resorption) — net anabolic signal

Clinical Pearl: The König 2018 study used a specific bioactive collagen peptide formulation. Response may vary with peptide source and molecular weight profile.

Meta-Analysis: Clinical Positioning

What the Evidence Shows

Recent meta-analysis (Sun et al. 2025) pooled multiple RCTs and found:

- Consistent improvements in bone formation markers across studies
- Modest but significant BMD gains in spine and hip regions
- Best results with 5–10g daily for ≥12 months
- Effects more pronounced in postmenopausal populations

Current Limitations

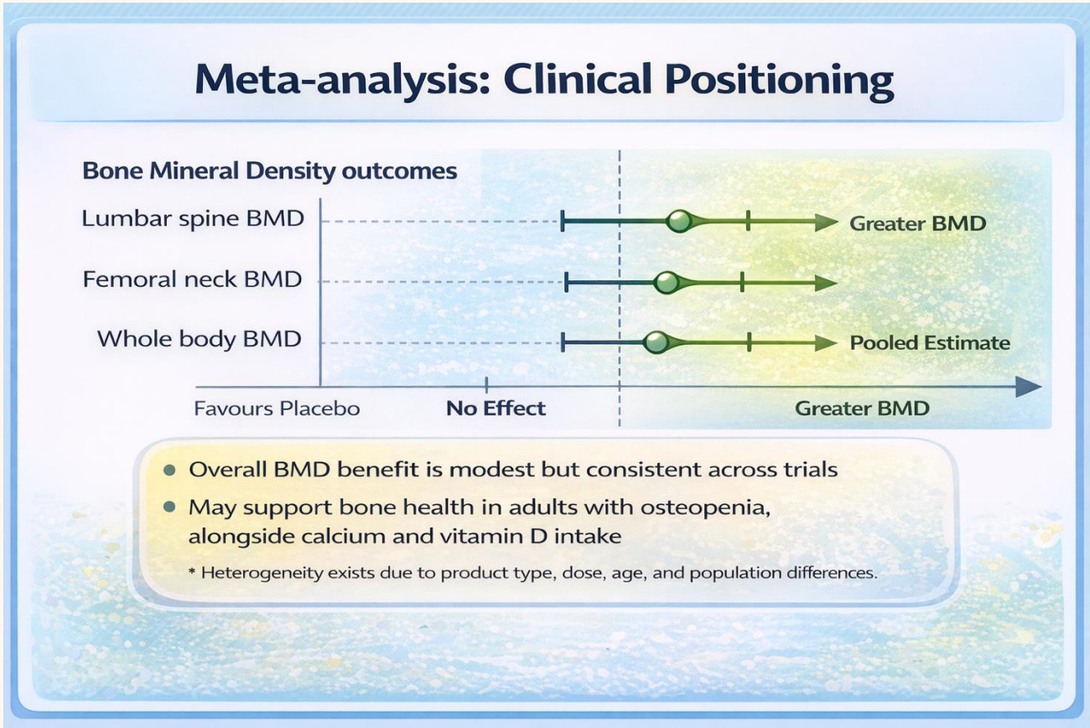
Heterogeneity in peptide types, study duration variability, and limited data in younger populations. Not a replacement for established osteoporosis therapies.

Effective Dose Range

5-10g

Months Needed

12+



Bone Outcomes: Where Collagen Fits

Bone Mineral Density (BMD)

Collagen peptides may support BMD maintenance in postmenopausal women and older adults through stimulation of osteoblast activity and modulation of bone remodeling pathways.

Evidence suggests modest improvements in spine and femoral neck BMD with consistent supplementation over 12+ months.

Bone Turnover Markers

More consistent effects observed on biochemical markers including:

- P1NP (bone formation marker) — typically increases
- CTX (bone resorption marker) — often decreases
- Osteocalcin and other regulatory proteins

Marker changes suggest favorable shift in bone metabolism balance.

König D, et al., 2018; Sun C, et atl., 2025

Evidence — Muscle & Sarcopenia

EMERGING APPLICATION

Collagen + Resistance Training

What It May Improve

- Fat-free mass gains in older adults (sarcopenic populations)
- Functional strength outcomes when combined with structured resistance training
- Body composition shifts (modest fat mass reduction)
- Connective tissue within and around muscle

What It Doesn't Replace

- High-quality, leucine-rich protein sources (whey, casein, etc.)
- Complete amino acid profile for muscle protein synthesis
- Gold-standard post-exercise recovery nutrition

Low Leucine Caveat: Collagen is naturally low in leucine (~2–3% vs. 10% in whey), limiting its direct mTOR activation. Best used as an adjunct, not a replacement for complete proteins.

Zdzieblik D, et al., 2015; Jacinto JL, et al., 2022; Bischof K, et al., 2024

CLINICAL APPLICATIONS

Wound Healing & Pressure Injury Management

Evidence-based strategies for integrating collagen peptides into nutrition care plans for wound healing and tissue repair.

RCT Evidence: Collagen Hydrolysate for Pressure Ulcer Healing

Lee SK et al., 2006

Adv Skin Wound Care – 89 nursing home residents with stage II–IV pressure ulcers. Collagen hydrolysate group showed improved healing vs. placebo at 8 weeks.

Yamanaka H et al., 2017

J Nutr Intermed Metab – Improved DESIGN-R scores and faster healing in elderly patients receiving collagen peptide supplementation alongside standard care.

Sugihara F et al., 2018

Sci Rep – Double-blind placebo-controlled trial demonstrated enhanced pressure ulcer healing rate and reduced wound size with collagen peptide intervention.

Note: All trials provided collagen peptides **in addition to** adequate baseline nutrition—not as a replacement for protein or calories.

PERIOPERATIVE & ORTHOPEDIC

Perioperative & Orthopedic Recovery

Emerging evidence for collagen peptides as a supportive adjunct in surgical recovery and tissue repair.

Emerging Evidence: Supportive Adjunct Role

ACL Rehabilitation Support

López-Vidriero E et al. (2019) found collagen peptide supplementation combined with progressive rehabilitation improved functional outcomes and patient-reported knee function post-ACL reconstruction.

Framing as Adjunctive

Current evidence suggests collagen peptides may support tendon, ligament, and joint cartilage remodeling—but always **alongside** physical therapy, adequate protein intake, and standard postoperative care.

What We Don't Know Yet

Large-scale RCTs in diverse surgical populations are lacking. Effect sizes are modest. Mechanism (direct vs. indirect via amino acid profile) remains under investigation.

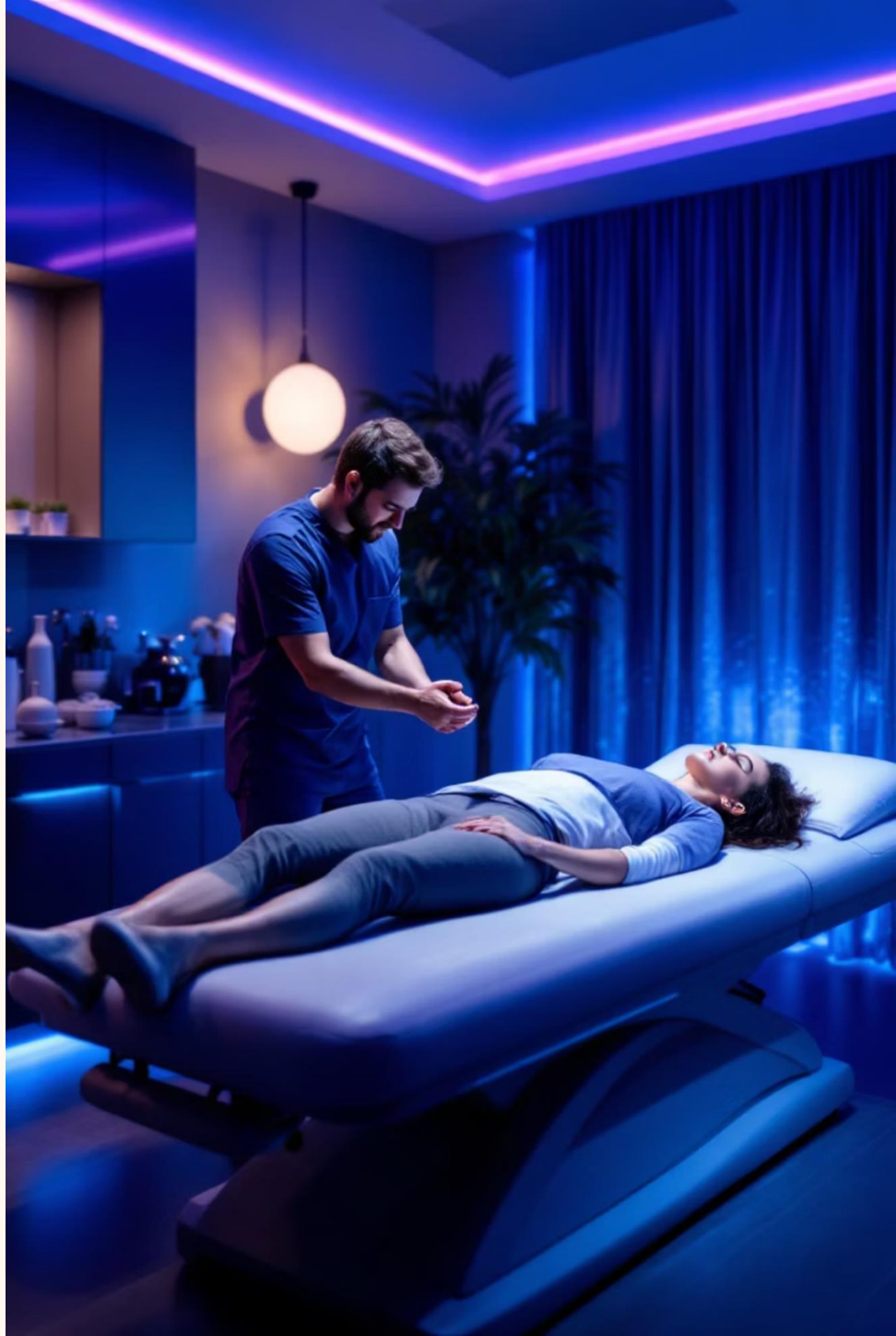
Caution: Avoid marketing language. Frame collagen peptides as **potentially supportive**, not curative or essential.

Hirsch KR, et al., 2021

MECHANISMS, EVIDENCE, & PRACTICE

Summary & Clinical Takeaways

Turning evidence into practical dosing, timing, and counseling guidance for HCPs



MECHANISMS

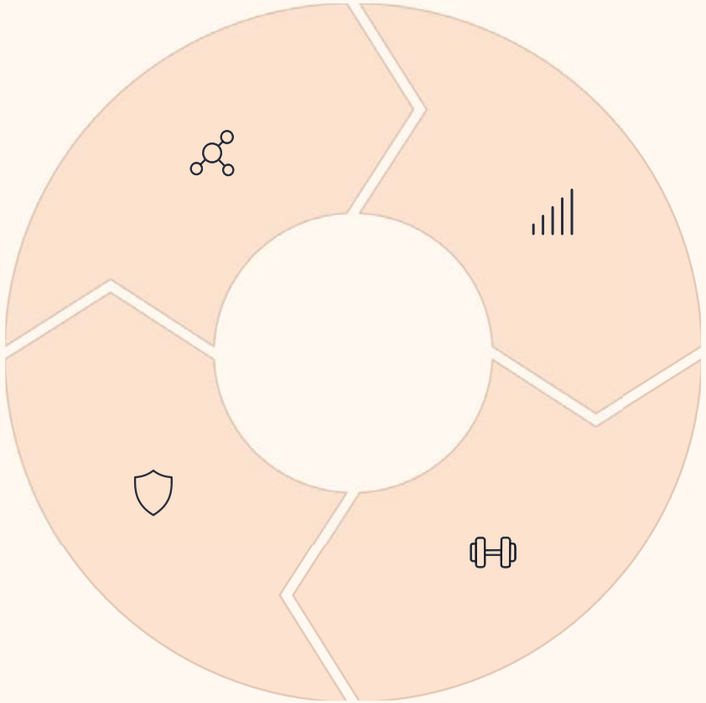
Summary of Mechanisms of Action

Substrate Provision

Supplies amino acids (glycine, proline, hydroxyproline) as building blocks for endogenous collagen synthesis

Matrix Protection

May inhibit matrix metalloproteinases (MMPs) that break down collagen, preserving tissue integrity



Cell Signaling

Bioactive peptides stimulate fibroblasts and chondrocytes to increase ECM production via receptor-mediated pathways

Mechanical Loading

Synergy with exercise: mechanical stress + peptide availability enhances tissue remodeling response

Vitamin C Synergy

Vitamin C is essential for hydroxylation of proline and lysine residues, stabilizing collagen structure. Co-supplementation (50-100 mg) enhances collagen synthesis.

Exercise Timing

Consuming collagen peptides 30-60 minutes before mechanical loading optimizes tissue availability during the anabolic window of tissue repair.

PRACTICAL GUIDANCE

Clinical Implementation: Dosing, Timing & Counseling Applications

Evidence-Based Dosing by Indication

Skin: 2.5-10 g/day | **Joints:** 10 g/day or 40 mg UC-II | **Bone:** 5-10 g/day | **Tendon/ligament:** 15 g/day pre-exercise

Optimal Timing Strategies

General use: any consistent time. For musculoskeletal rehab: 30-60 min before loading/exercise. With vitamin C (50-100 mg) to enhance synthesis.

Setting Realistic Expectations

Educate on timeline: 4-8 weeks for **skin,** 12-24 weeks for **joint** benefits. Emphasize consistency. Not a replacement for comprehensive nutrition or medical therapy.

Product Quality Considerations

Recommended products Verify collagen source and hydrolysis method and type. Check for added sugars or unnecessary ingredients.

Safety Profile: Collagen peptides demonstrate excellent safety and tolerability. Mild GI effects (fullness, mild nausea) reported rarely. No significant drug interactions identified. Consider individual allergies to source material (bovine, marine, chicken).

Khatri M, et al.. 2021; Lugo JP, et al., 2016

Dosing and Timing Summary

Goal	Dose (daily)	Trial Duration	Best paired with	What to tell patients
Skin	2.5–10 g	8–12 weeks	Adequate protein + skincare	30–60 min pre-session most commonly used
OA pain/ function	5–15 g	8–24 weeks	Strengthening/PT + weight management	8–12 weeks
Bone health	~5 g	6–12 months	Resistance training + Ca/Vit D	Supportive adjunct; not a substitute for osteoporosis care
Tendon/ ligament rehab	10–15 g pre-loading*	weeks-months	Loading/rehab + Vit C	Most compelling when timed around rehab/loading.
Wound healing/ pressure injury	variable**	4–12 weeks	Energy + protein sufficiency + standard wound care	Consider adjunct in high-risk patients; avoid overpromising.

Skin: de Miranda 2021; Dewi 2023 | OA: Liang 2024; Lugo 2016 | Bone: König 2018; Sun 2025 | Tendon: Shaw 2017 | Wounds: Sugihara 2018

Key Takeaways & Questions

Evidence-Based, Not Hype-Based

Collagen peptides show promise for wound healing and tissue recovery—but always as part of comprehensive nutrition and rehab care.

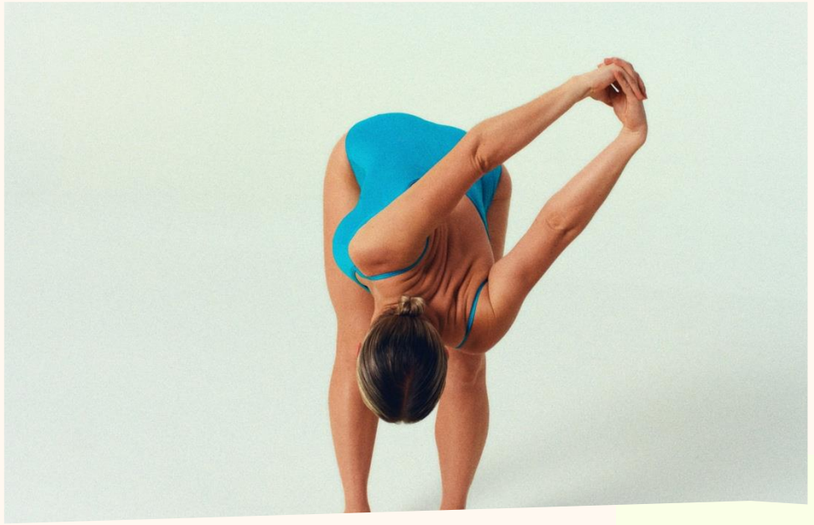
Individualize & Monitor

Assess baseline nutrition, set realistic expectations, and use validated tools to track outcomes. Not every patient will benefit equally.

Quality Matters

Trusted products, screen for allergens, and counsel on appropriate dosing and timing for target tissues.

Questions?



Thank you for joining us today.

RDNs and NDTRs, please complete the short survey after the webinar to download a CPEU certificate!

Orgain®

Professional Education Series

Support. Inform. Educate. Empower.

WEBINAR HOST:

Keith Hine, MS, RD
VP of Healthcare, Sports & Professional Education
Orgain, LLC

keith.hine@orgain.com

WEBINAR PRESENTER:

Shiloah Kviatkovsky, Ph.D, CISSN
Assistant Professor, Department of Orthopaedics
University of Arkansas for Medical Sciences

skviatkovsky@uams.edu

ORGAIN INQUIRIES:

medinfo@orgain.com