

Joints That Last

A physician's home guide to why joints ache with age – and the simple, old, under-used tools that feed, soften, and strengthen them.

Dr. Sara Hazel

Naturopathic physician · Barefoot Sage Center

Age is often blamed for the pain and reduced function of our joints, and while there is truth to that, it often becomes an excuse that prevents the real improvements that correct care can bring.

I think we fail to appreciate how much chronic low-level pain and tension drains our energy, triggers our stress response, and keeps us in fight-or-flight overdrive. Pain, even low-level pain, eats away at our longevity, wellbeing, and happiness. Removing this energy drain frees up resources for healing other conditions — and frees up resources for making new changes and achieving other goals.

PART ONE

The five real changes of aging joints

A few things really are changing as we age, and it helps to break them down, because each one can be worked with:

- 1 **An accumulation of macro and micro damage.** We prevent damage where we can and treat the damage that has occurred where possible — which means paying attention to how we use our bodies and how we caretake recovery when the joints have been stressed.
- 2 **Reduced number and function of mitochondria.** This means less energy available for healing and repair, and poorly functioning mitochondria also create more inflammation, releasing more reactive oxygen molecules than our antioxidant systems can neutralize. Laboratory studies of human joint cartilage show that cartilage cells in arthritic joints have measurably weaker mitochondria — less energy for repair, more oxidative stress and inflammation.
- 3 **Hormone changes.** Testosterone, growth hormone, estradiol, and thyroid, among others, influence strength, muscle health, repair capacity, inflammation, circulation, collagen, elastin, and bone density. Joint tissues respond to hormones — estrogen receptors are found throughout cartilage, bone, and the joint lining, and osteoarthritis becomes markedly more common in women after menopause. Trials of hormone therapy for joint symptoms have shown mixed results, so this is a conversation to have individually, not a blanket prescription.
- 4 **Fascia becomes dry, tighter, and more bound in three-dimensional space.** Fascial binding generates pain signals, reduces circulation, creates muscle tension, and holds the body in positions that increase the risk of joint and movement problems.
- 5 **Nutrient needs change.** The aging digestive tract handles food differently — research documents declines in digestion, motility, and the gut wall's ability to extract certain nutrients. In practice this means older adults often need more of specific nutrients — protein, B12, vitamin D, calcium — to maintain the same tissue, even eating the same diet.

PART TWO

The joint, layer by layer

A joint is not a hinge; it is layered living tissue, and each layer eats, drinks, and repairs differently. Working from the inside out: bone, then cartilage and its fluid, then the capsule, then fascia, then muscle. Underneath all of them run the same three currents — microcirculation (the supply lines), mitochondria (the power plants), and inflammation (the signal system).

Bone – living, rebuilding, and load-hungry

Bone is not a dead scaffold. It is living tissue that constantly rebuilds itself toward the loads you give it — which is why loading is the deposit and stillness is the slow withdrawal. Walking gives load with less joint stress than running. Weight training loads more directly, and supervised high-intensity resistance and impact work has good trial evidence even in postmenopausal women with low bone mass.

A SMALL PROTOCOL WITH REAL EVIDENCE

In a controlled trial, premenopausal women who did ten to twenty jumps twice a day, with thirty seconds of rest between each jump, measurably increased the bone density of their hips within sixteen weeks. The rest between jumps matters — bone responds strongly to signal, but only briefly, so spacing the signal out is what makes ten jumps count. If you are postmenopausal or have known bone-density concerns, have the jumping conversation with someone like me first; there is a supervised version with even better evidence behind it.

Vibration platforms, honestly graded: pooled trials in postmenopausal women suggest a small gain in spine bone density, but no clear effect at the hip — the evidence for loading exercise remains stronger. At the Center we use vibration as a complement to loading and for its tissue and circulation benefits, never as a substitute.

BONE-NUTRIENT MATRIX

NUTRIENT	WHAT IT DOES	HIGH-YIELD FOOD SOURCES
Calcium	Structural block; hardens skeletal mass	Milk, yogurt, sardines with bones, tofu, kale
Vitamin D3	Gut calcium absorption	Salmon, egg yolks, fortified foods, sunlight
Magnesium	Activates D; regulates bone calcium	Almonds, spinach, black beans, pumpkin seeds
Vitamin K2 (MK-7)	Activates osteocalcin — locks calcium into bone (long-acting)	Natto, fermented cheeses, sauerkraut
Vitamin K2 (MK-4)	Same activator, shorter-acting	Egg yolks, grass-fed butter, dark chicken meat
Vitamin K1	Clotting; minor bone role	Spinach, kale, Brussels sprouts, broccoli
Protein	Collagen scaffold — about half of bone volume	Eggs, chicken, tofu, lentils, white fish
Phosphorus	Pairs with calcium to form bone mineral	Pumpkin seeds, parmesan, lean meats, nuts
Vitamin C	Collagen synthesis catalyst	Oranges, red peppers, strawberries, kiwi
Zinc	Stimulates bone-building cells	Beef, chickpeas, pumpkin seeds, hemp hearts
Boron	Extends vitamin D and estrogen activity; reduces calcium loss	Prunes, raisins, avocados, almonds, apples
Silica	Cross-links collagen against brittleness	Oats, brown rice, green beans, bamboo shoots
Strontium (dietary)	Supports building while slowing breakdown — food sources only	Clams, oysters, whole wheat, root vegetables

The sequence matters: D3 absorbs the calcium; boron and magnesium retain it; protein, vitamin C, and silica build the scaffold; K2 targets calcium into the grid; zinc keeps the build-versus-breakdown balance honest. Food first — the matrix above is written as a menu, not a supplement list.

Cartilage and synovial fluid – fed only by movement

Cartilage has no blood supply of its own. It is fed only when the joint moves, by fluid that motion pumps through the tissue. This is why the right kind and amount of movement is not optional maintenance; it is how the joint eats. A joint that does not move is not being maintained or repaired — and it becomes stuck, bound, and stiff besides.

SYNOVIAL-JOINT NUTRIENT MATRIX

NUTRIENT	WHAT IT DOES	HIGH-YIELD FOOD SOURCES
Hyaluronic acid	Moisture and viscosity of joint fluid	Bone broth, organ meats, root vegetables
Glucosamine	Building block of the cartilage matrix	Shellfish-derived, bone broth (caution: shellfish allergy)
Chondroitin	Draws water into cartilage; elasticity	Animal cartilage, bone broth
Omega-3 (EPA/DHA)	Quiets inflammatory pathways	Wild salmon, mackerel, sardines, algae oil
MSM (sulfur)	Stabilizes collagen	Garlic, onions, cruciferous vegetables
Type II collagen	Cartilage's structural mesh	Chicken cartilage, bone broth
Vitamin C	Collagen cofactor; antioxidant	Citrus, bell peppers, strawberries, broccoli
Manganese	Activates cartilage-protein enzymes	Oats, hazelnuts, brown rice, spinach
Copper	Cross-links collagen and elastin	Beef liver, oysters, dark chocolate, sunflower seeds
Turmeric (curcumin)	Calms inflammatory enzymes; synovial protection	Turmeric root with black pepper
Ginger (gingerols)	Reduces inflammatory messengers in joint lining	Fresh ginger root

Think of the joint's interior as three working zones: the *lubricant* (hyaluronic acid, protected by the anti-inflammatory foods), the *shock absorber* (the collagen scaffold packed with water-holding glucosamine and chondroitin), and the *chemical anchors* (vitamin C, manganese, and copper, cross-linking the structure against fraying).

A word on absorption, honestly given: glucosamine, chondroitin, and large hyaluronic acid molecules absorb poorly from food alone; hydrolyzed collagen peptides absorb better, and several randomized trials, pooled in two meta-analyses, found that daily collagen peptides modestly reduced arthritis pain and stiffness compared with placebo — small, imperfect trials, but pointing in a consistent direction. On glucosamine and chondroitin themselves, the largest trial found them overall no better than placebo for knee arthritis pain — but the subgroup with moderate-to-severe pain did respond to the combination. The evidence is honestly mixed: some people respond well, many don't, and it is very safe to try. Pair the fat-soluble anti-inflammatories (curcumin, omega-3s) with fats at the meal.

The capsule and synovium – the oil-making factory

The joint capsule and its lining make the fluid everything else depends on. It is worked from the inside — nutrients and water — and from the outside: oils, warmth, and range of motion.

Fascia and the interstitium – a dynamic organ, not wrapping

Anatomists have recently described a body-wide, fluid-filled interstitial network running through human tissue — a lattice of collagen and elastin holding fluid-filled compartments, involved in joint mechanics, body-position sense, and chronic pain. When it is healthy, fluid flows and tissues glide over one another. When it is restricted — by inflammation, stress, or simple stillness — the fluid thickens toward a sticky, compressed glue that presses on pain-sensitive nerves and binds the joints. Fascia researchers call this "densification," and the encouraging part is that unlike scar tissue, it appears reversible. This is an emerging model in the research — and it matches exactly what hands-on practitioners feel in tissue every day.

Caring for this layer is fluid work:

- **Move in three dimensions.** Fascia thrives on spirals, twists, and gentle bounces — qi gong, yoga, dance. Purely linear training breeds rigid cross-links. And the two-minute rule: move at least two minutes every hour, because static posture chokes the flow.
- **Squeeze and refill.** Slow, pressurized compression — rolling, balls, hands — expels stagnant, waste-laden fluid; the release vacuums fresh fluid in. Sustained one-to-three-minute holds let dense fascial sheets yield. Drinking water is not enough on its own — it has to be pumped into the tissue.
- **Eat against the glue.** Refined sugars stiffen the web through cross-linking; omega-3s soothe it; the matrix wants its precursors — glycine, proline, vitamin C, zinc, copper, sulfur-rich foods — and water-dense plants.
- **Work the nervous system.** Fascia is densely wired with stress-responsive nerves, and chronic stress contracts it independently of the muscles. Long-exhale breathing lowers resting fascial tone, and deep sleep is when fascial remodeling actually happens.

Muscle and tone – the guard system

Muscle is the joint's bodyguard, and it can fail in two directions: too weak, and the joint is unprotected; too braced, and the joint is compressed all day. A braced muscle is a joint in fight-or-flight. Strength work protects; down-regulation — the relaxation practices, the breathing, the warmth — decompresses. Both are joint therapy, and this is where joint care joins the larger story of getting a body out of survival mode.

PART THREE

The thermal toolkit – heat, cold, and contrast

Fascia is viscoelastic: temperature changes its physical state, which is why the oldest tools in medicine still work.

Heat melts and opens. Warmth lowers the viscosity of the tissue's lubricating fluid — thick honey toward slick oil — and heated connective tissue measurably yields more easily to stretch and release. In thirty years of practice I've found hot compresses in the 103–105°F range the most useful for softening muscle and fascia — hot enough to change the tissue, cool enough to hold for minutes — with the usual cautions about protecting sensitive skin from burns. Warmth also dilates vessels, flooding the tissue with oxygen, nutrients, and hydration, and calms pain signaling directly.

Cold firms and quiets. Fascia stiffens, fluid thickens, vessels constrict — a dam against swelling — and nerve conduction slows, which is powerful numbing for acute flares and spasm.

Contrast pumps. Alternating heat and cold alternately dilates and constricts the vessels, creating pressure waves that flush stagnant metabolic waste out of congested tissue and draw fresh fluid in — arguably the fastest thermal route to restored glide.

CHOOSING THE TEMPERATURE

Therapy	Direct Action on the Tissue	Best Timing
Heat only	Melts the fluid "glue"; increases glide and stretch tolerance	Before movement; morning stiffness; before mobility work
Cold only	Thickens fluid; constricts vessels; blunts pain conduction	Right after injury; acute flares; serious swelling
Contrast	Pumps stuck fluid through the tissue channels	Recovery days; chronic joint fogginess and fatigue

PART FOUR

Earth – grounding and mud

Earthing (grounding) is direct skin contact with the earth's surface — barefoot on grass, sand, or soil. The proposed mechanism: the earth's surface carries a subtle negative charge rich in free electrons; chronic inflammation generates electron-hungry free radicals; direct contact supplies electrons that help neutralize them. The research, stated honestly: small pilot studies — a dozen or fewer people each, mostly without control groups — have reported that grounding is associated with lower night-time cortisol, improved red-blood-cell charge and flow, and shifts in inflammatory

markers. This is preliminary, proof-of-concept research, not established medicine. It is also free, pleasant, and safe — which is why it leads my home protocol below.

Mud packs (peloid therapy) are matured, mineral-rich earth applied over the joint, and here the trial evidence is genuinely good. Mud's high specific heat gives a slow, uniform, deep thermal release that penetrates the fascial layers without burning the skin, while the skin absorbs bioactive minerals — sulfur, magnesium, silica. Randomized trials in knee arthritis have found that mud-pack therapy reduces inflammatory messengers such as TNF- α and raises IGF-1, a growth factor that supports cartilage cells. And in one trial, mud applied directly to the skin outperformed the identical heat delivered through a plastic barrier for lasting pain relief — suggesting the minerals themselves contribute, not just the warmth.

The Joint Care Series – my home protocol

This is the sequence I teach and use. Pick one joint that troubles you, give it this series a few times in a week, and pay attention to what changes. None of it requires a prescription, and every piece is doing something real — feeding cartilage, softening fascia, pumping circulation through tissues that blood barely reaches, and telling a braced, guarded body that it is safe to stand down.

1

Ground

Stand or lie barefoot on the earth for 30 minutes — 60 is better. This is the system-wide down-shift that everything after it lands on.

2

Warm

Warm the joint: a hot water bottle, bath, shower, or hot tub. A local application in the 103–105°F range, tolerated for around five minutes, is most effective — protect sensitive skin.

3

Oil

Massage warm castor oil and arnica oil into the joint. This pairing comes from long naturopathic tradition and my own decades of practice; arnica additionally carries a randomized trial in which arnica gel relieved hand-arthritis pain as well as ibuprofen gel.

4

Move

Take the joint through its range of motion, add some sustained stretches, and a little vibration or shaking. The warmed, oiled, fed joint is now actually eating.

5

Light or earth

Follow with red or near-infrared light for several minutes — or a moor mud or Epsom salt pack. This is the deep-tissue and mitochondrial layer of the series.

6

Contrast

Finish with alternating hot and cold: three to five minutes of heat, one to three minutes of cold, repeated three times. The vasomotor pump — flush and finish.

Why it is sequenced this way: ground first (system-wide down-shift), warmth second (melt and open), oils third (carry and soothe), movement fourth (pump the fed joint), light or mud fifth (deep tissue and mitochondria), contrast last (flush and finish).

A PHYSICIAN'S CAUTIONS

Heat: stay in the tolerable range and protect thin or sensitive skin from burns. Anyone on anticoagulant therapy should review vitamin K foods, high-dose omega-3s, and related choices with their prescriber — a general caution I give with all of this work. Shellfish-derived glucosamine is off the table for shellfish allergy. Strontium here means food sources only. Jumping protocols: if you are postmenopausal or have known bone-density concerns, get supervision first. And none of this replaces the individual assessment a persistent, worsening, hot, or swollen joint deserves.

IF YOU WANT THE WHOLE TOOLKIT

The full Joints That Last class — all five layers, every tool, taught live with questions answered — is in The Longevity Studio library, beside every class we've recorded and the live-streamed series that continues each week. Charter membership is \$59/month, locked for life for the founders.

barefootsagecenter.com/membership

Selected references

Every citation below was verified against the primary literature before this guide shipped. Evidence grades vary and are stated honestly in the text.

Blanco FJ, Rego I, Ruiz-Romero C. The role of mitochondria in osteoarthritis. *Nat Rev Rheumatol*. 2011;7(3):161–169. PMID 21200395.

Roman-Blas JA, et al. Osteoarthritis associated with estrogen deficiency. *Arthritis Res Ther*. 2009;11(5):241. PMID 19804619.

Rémond D, et al. Understanding the gastrointestinal tract of the elderly. *Oncotarget*. 2015;6(16):13858–13898. PMID 26091351.

Tucker LA, et al. Effect of two jumping programs on hip bone mineral density in premenopausal women. *Am J Health Promot*. 2015;29(3):158–164. (Ten to twenty jumps twice daily, 16 weeks.)

Kato T, et al. Effect of low-repetition jump training on bone mineral density in young women. *J Appl Physiol*. 2006;100(3):839–843.

Watson SL, et al. High-intensity resistance and impact training in postmenopausal women with low bone mass — the LIFTMOR trial. *J Bone Miner Res*. 2018;33(2):211–220.

Mohammad Rahimi GR, et al. The effect of exercise interventions on bone mineral density in postmenopausal women — meta-analysis. *Calcif Tissue Int*. 2020;106(6):577–590. PMID 32055889.

Benias PC, et al. Structure and distribution of an unrecognized interstitium in human tissues. *Sci Rep*. 2018;8:4947. PMID 29588511.

Pavan PG, Stecco A, Stern R, Stecco C. Painful connections: densification versus fibrosis of fascia. *Curr Pain Headache Rep*. 2014;18(8):441. PMID 25063495.

Stausholm MB, et al. Efficacy of low-level laser therapy on pain and disability in knee osteoarthritis — meta-analysis of randomised placebo-controlled trials. *BMJ Open*. 2019;9(10):e031142. PMID 31662383.

Lin CR, et al. Analgesic efficacy of collagen peptide in knee osteoarthritis — meta-analysis. *J Orthop Surg Res*. 2023;18:694. PMID 37717022.

García-Coronado JM, et al. Effect of collagen supplementation on osteoarthritis symptoms — meta-analysis. *Int Orthop*. 2019;43(3):531–538. PMID 30368550.

Clegg DO, et al. Glucosamine, chondroitin sulfate, and the two in combination for painful knee osteoarthritis (GAIT). *N Engl J Med*. 2006;354(8):795–808. PMID 16495392.

Widrig R, et al. Choosing between NSAID and arnica for topical treatment of hand osteoarthritis. *Rheumatol Int*. 2007;27(6):585–591. PMID 17318618.

Lehmann JF, et al. Effect of therapeutic temperatures on tendon extensibility. *Arch Phys Med Rehabil*. 1970;51(8):481–487. PMID 5448112.

Knight CA, et al. Effect of superficial heat, deep heat, and active exercise warm-up on the extensibility of the plantar flexors. *Phys Ther*. 2001;81(6):1206–1214. PMID 11380276.

Ghaly M, Teplitz D. The biologic effects of grounding the human body during sleep. *J Altern Complement Med*. 2004;10(5):767–776. PMID 15650465. (Pilot, n=12.)

Chevalier G, et al. Earthing (grounding) the human body reduces blood viscosity. *J Altern Complement Med*. 2013;19(2):102–110. PMID 22757749. (Pilot, n=10.)

Brown D, et al. Pilot study on the effect of grounding on delayed-onset muscle soreness. *J Altern Complement Med*. 2010;16(3):265–273. PMID 20192911. (Pilot, n=8.)

Sarsan A, et al. Comparing the efficacy of mature mud pack and hot pack treatments for knee osteoarthritis. *J Back Musculoskelet Rehabil*. 2012;25(3):193–199. PMID 22935858.

Mahboob N, et al. The efficacy of a topical gel prepared using Lake Urmia mud in patients with knee osteoarthritis. *J Altern Complement Med.* 2009;15(11):1239–1242. PMID 19922256.

Odabasi E, et al. Does mud pack treatment have any chemical effect? *J Altern Complement Med.* 2008;14(5):559–565. PMID 18564957.

Lu M, et al. (BMJ walking analysis) Comparative effectiveness of exercise interventions for knee osteoarthritis — network meta-analysis of 217 trials. *The BMJ.* 2026. (See the newsletter's news item.)

This guide is educational and reflects the clinical experience of Dr. Sara Hazel and the published research cited above. It is not individual medical advice, and it does not replace assessment of your particular joints, medications, and history. A persistent, worsening, hot, or swollen joint deserves an examination.

© 2026 Barefoot Sage Center · 14 E. Birch Ave, Flagstaff, Arizona · barefootsagecenter.com