

## **The Silent Saboteur: How Glucose Control Impacts Cartilage Health and Osteoarthritis**

I work with a lot of people with arthritis that includes people in workplaces, elite athletes, elderly and many more, and there is one thing in common with almost everyone, they neglect the importance of glucose control for managing osteoarthritis. For years, cartilage degeneration and osteoarthritis (OA) were thought to be purely mechanical — a "wear-and-tear" disease driven by age, activity, or injury. But as our understanding of joint biology deepens, it's becoming clear that systemic metabolic factors, especially glucose regulation, play a critical role in cartilage health, inflammation, and the body's capacity for repair.

I want to share with people some of the things I have learned over time and explore the emerging link between glucose dysregulation and early joint degeneration, and why glucose control should be considered a core pillar in exercise physiology programs for clients with OA or cartilage damage — **even if they're not diabetic.**

### **Cartilage: A Metabolically Sensitive Tissue**

Articular cartilage is unique:

- It is avascular (very little blood supply), relying entirely on diffusion from synovial fluid for nutrients.
- It contains chondrocytes (specialised cartilage cells) that are highly sensitive to their chemical environment.
- It has limited regenerative capacity, making it vulnerable to progressive damage.

This means that systemic inflammation, hormonal imbalances, or elevated glucose levels can disrupt cartilage integrity — not just at the site of injury, but systemically.

### **High Blood Glucose = Pro-Inflammatory Setting**

Elevated glucose levels trigger:

- Increased production of pro-inflammatory cytokines such as IL-6, TNF-alpha, and CRP.
- Activation of macrophages within the joint lining, which release cartilage-degrading enzymes (e.g. MMPs).
- Infiltration of AGEs (Advanced Glycation End Products) into cartilage, which cause stiffening, brittleness, and impaired shock absorption.

### **Takeaway:**

**Even modest glucose spikes in non-diabetic individuals can create a joint environment that accelerates degeneration.**

### **AGEs: The Hidden Threat in Sugar**

AGEs are proteins or lipids that become glycated after exposure to sugar. Within joints, they:

- Bind to chondrocyte receptors and trigger apoptosis (cell death)
- Increase stiffness of the collagen matrix
- Impair response to growth factors and mechanical loading

This is especially relevant for clients with:

- High-sugar diets
- Insulin resistance or PCOS
- Sedentary lifestyles

### **Impaired Healing and Regeneration**

Clients with poor glucose control often:

- Respond less effectively to PRP or other therapies
- Experience slower soft tissue healing (ligaments, cartilage, tendons)
- Show reduced mitochondrial activity and impaired collagen synthesis

For clinicians using regenerative interventions, glucose management is a low-cost, high-impact adjunct that enhances response to treatment.

### **Exercise Physiology Implications: What Should We Do?**

#### **1. Educate Clients on the Glucose–Joint Connection**

- Explain how food and blood sugar affect not just energy, but inflammation and healing
- Use analogies: “Too much sugar makes your joints sticky and brittle, like caramelizing rubber.”

#### **2. Prescribe Regular, Rhythmic Exercise**

- Improves insulin sensitivity and mitochondrial health
- Enhances synovial fluid circulation to nourish cartilage
- Reduces systemic inflammatory markers

#### **3. Introduce Backward Treadmill Walking**

- Promotes eccentric quad loading, improves joint alignment
- Enhances nutrient diffusion through synovial movement
- Safe for early-stage OA and excellent for clients hesitant about joint loading

#### 4. Integrate Nutrition and Sleep Support

- Include omega-3s, curcumin, collagen with vitamin C
- Address sleep, as poor sleep increases insulin resistance and inflammation

#### 5. Screen for Hidden Glucose Issues

- Monitor HbA1c, fasting glucose, or even trial a CGM (e.g. Freestyle Libre) in clients with unexplained flare-ups or slow healing
- Look for post-meal crashes or brain fog as signs of dysregulated glucose

#### Case Insight: Why Two Clients with the Same Joint Damage Heal Differently

One eats whole foods, trains 3x/week, sleeps 8 hours.

The other skips meals, drinks energy drinks, and doesn't recover well.

Both have the same imaging. But the former's joint is *biologically primed to repair*, while the latter's is trapped in a pro-inflammatory loop.

**Same injury, different metabolic context = different outcomes.**

The most advanced rehab program can only go so far if the cellular environment is inflamed and glucose compromised. As exercise physiologists, we're in a powerful position to influence that.

By combining targeted loading with metabolic awareness, we give joints not just motion — but a real chance to heal.