

Tendons, Keith Baar and isometrics: evidence map

Visual deck: engineered ligament logic, tendon loading meta-analyses, isometric rehab evidence and Abrahams data.

10 min

short tissue-loading
bout

~6 h

cell response recovery
window

0.74

tendon stiffness SMD
after loading

$\geq 70\%$

high-intensity
contractions for
tendon adaptation

+5.8%

Abrahams + max hangs
mean change

Baar lens

Tendon is not passive rope. It adapts to specific mechanical loading, nutrient context and recovery windows.

Isometric nuance

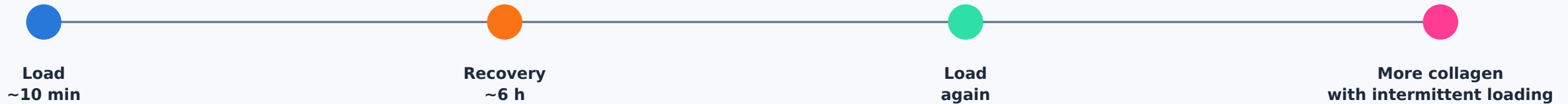
Useful for analgesia and controlled loading, but not superior to isotonic loading across chronic tendinopathy trials.

Performance lens

Strength and tendon remodeling need intensity, strain, muscle length, intent and progression, not just hold time.

Baar model: short loading + long recovery window

Engineered ligament studies suggest cells become temporarily refractory after loading and recover responsiveness after roughly 6 hours.



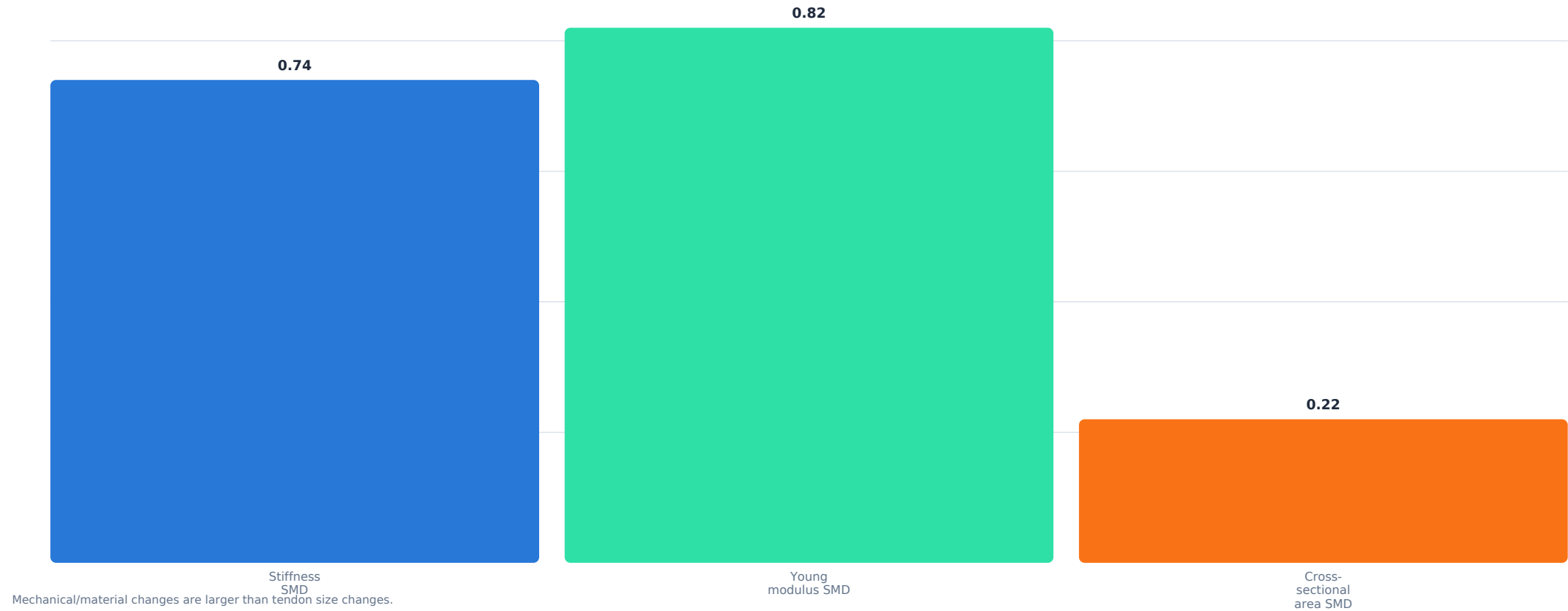
Video line

“The Baar idea is not endless tendon work. It is a small mechanical signal, enough substrate and time for cells to respond.”

Mechanical loading changes tendon properties

Laza

Lower-limb tendon adaptation to mechanical loading



Isometric exercise for tendinopathy: what the trials say

Great starting tool for some patients; not a universal analgesic or superior long-term treatment.

Evidence	Protocol / design	Bottom line
Rio 2015	Patellar tendinopathy; 5 x 45 s isometric knee extension	Large immediate pain reduction in a small sample.
Holden 2020	Crossover comparison of isometric and dynamic exercise	Analgesic response was not universal.
Clifford 2020	Systematic review/meta-analysis of RCTs	Isometrics not superior to isotonics for chronic tendinopathy pain; response variable.
Li 2024	Network meta-analysis in patellar tendinopathy	HSR/moderate slow resistance ranked high; progressive loading beats “one exercise solves all”.

Hold duration is not the main variable

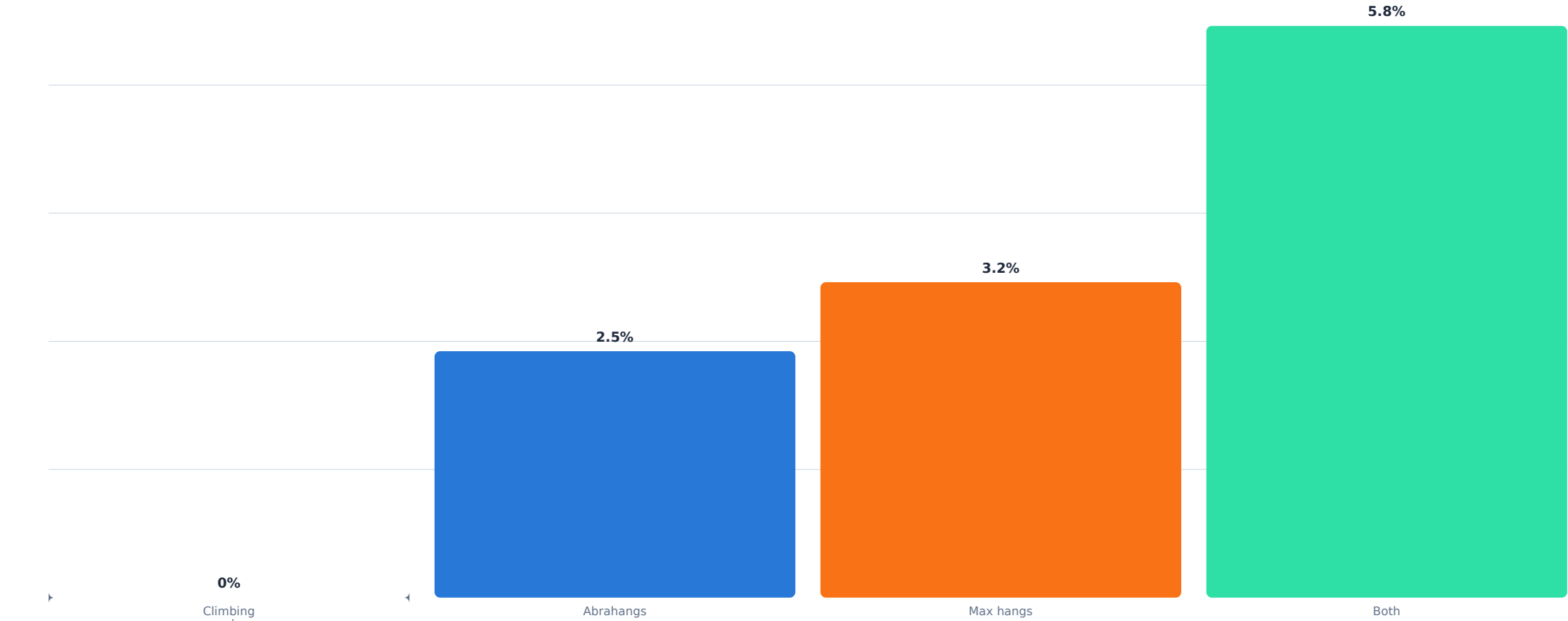
For strength and tendon adaptation, manipulate intensity, joint angle/muscle length, intent and progression.

Variable	What evidence suggests	Practical translation
Duration	30-45 s holds are common for analgesia protocols.	Use long holds when pain modulation/control is the goal.
Intensity	>=70% contractions needed for tendon structure/function in isometric review.	Progress intensity once tolerated.
Muscle length	Long muscle length isometrics transfer better to dynamic performance and hypertrophy.	Choose joint angles that matter for the sport/tendon.
Intent	Ballistic intent can improve neural activation and rapid force production.	Use “push fast” cues when RFD matters.

Abrahangs retrospective study: finger-strength data

Cri

Mean change in finger strength



Cohen d reported: Abrahangs 0.29, Max Hangs 0.45, Both 0.79. Retrospective design limits causality.

Tendon rehab progression

Isometrics can open the door; they should not be the whole house.

Pain control

isometric holds / low flare

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Capacity

heavy slow resistance

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Energy storage

plyometrics, spring-like loading

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Sport return

speed, fatigue, angles

Practical claim

“Tendon rehab is progressive loading plus symptom response. Isometrics are a phase or tool, not the full program.”

Talk-track: precise claims

Use these as on-screen bullets.

- Baar's tendon idea: short, targeted loading can be enough to stimulate collagen signaling if recovery windows are respected.
- Mechanical loading increases tendon stiffness and modulus more than it increases tendon size.
- Isometrics are useful for analgesia and controlled loading, but evidence does not show they are superior to isotonic exercise for chronic tendinopathy.
- For strength/tendon remodeling, hold time matters less than intensity, strain, muscle length, intent and progression.
- Abrahams are interesting and practical, but the main study is retrospective: treat it as a hypothesis, not a final law.

References

Source	Main contribution
Baar 2017	Engineered ligaments: short mechanical loading, ~6 h refractory period; practical 10 min loading bouts around connective tissue.
Tam & Baar 2025	Review of load-specific remodeling in tendon/ligament/fascia/cartilage: tension, compression and shear regulate different pathways.
Lazarczuk et al. 2022	Meta-analysis: mechanical loading increases lower-limb tendon stiffness (SMD 0.74), modulus (0.82), CSA (0.22).
Oranchuk et al. 2019	Systematic review: high-intensity ($\geq 70\%$) isometrics required for tendon structure/function; long muscle length improves transfer.
Rio et al. 2015	Patellar tendinopathy: 5 x 45 s isometric knee extension reduced pain acutely in a small cohort.
Clifford et al. 2020	Systematic review/meta-analysis: isometrics not superior to isotonics in chronic tendinopathy; response variable.
Kongsgaard et al. 2009	Patellar tendinopathy: heavy slow resistance produced structural and clinical improvements.
Beyer et al. 2015	Achilles tendinopathy: eccentric and heavy slow resistance both improved outcomes; HSR had high satisfaction/compliance.
Li et al. 2024	Network meta-analysis in patellar tendinopathy: HSR/moderate slow resistance ranks high for VISA-P; progressive loading better than eccentric alone.
Gilmore, Abrahamsson & Baar 2024	Retrospective Crimpd app study: Abrahams, max hangs and combined protocols increased finger strength; combined largest.