Hyaluronidase Injections for Chronic Muscle Stiffness from Posterior Tibialis Tendinopathy

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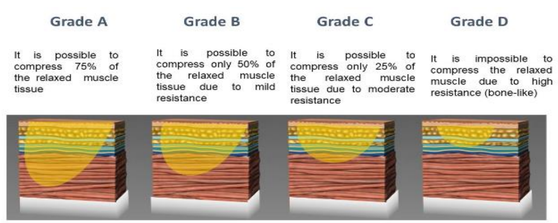
Case Description

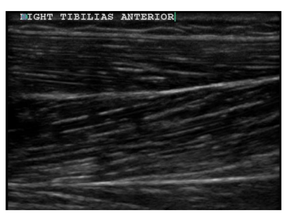
15 year old female, an elite squash player, presented for evaluation of chronic lower limb muscle stiffness with underlying posterior tibialis tendinopathy for the last five years treated with rest. She was found to have accessory navicular bones bilaterally that predisposed her to overuse injury of the posterior tibialis muscle. The presenting problem began during a match, approximately 18 months prior, with onset of muscle spasms and swelling over both shins accompanied by cramping pain in the medial arch. The symptoms progressed to include pain and stiffness in both lower limbs exacerbated during her menstrual cycle. Placental matrix therapy worsened symptoms. Fascial manipulation (deep friction massage) in both lower limbs helped improve her pain and stiffness. Her compartment pressures were measured as 28 mmHg (right) & 40 mmHg (left). Her daily post-training regimen included compression boots with legs elevated for 20 min, ice-bath, hot bath, infrared sauna, thera-gun and magnesium hot bath, which provided temporary relief. She had significant tightness in bilateral shins and calves with swelling below the lateral malleolus. She was referred by her Orthopedic surgeon and her Chiropractic physician for evaluation for treatment of lower limb muscle stiffness with off-label hyaluronidase injections.

Assessment

The **Stiffness rating scale was used to** assess the degree of muscle stiffness.



Grey-scale ultrasound was used to assess the echogenicity of selected stiff muscles using **Heckmatt's rating scale**: Grade 1 = normal, 2 = increase in muscle echo while bone echo is still distinct, 3 = marked increase in muscle echo and reduced bone echo, 4 = very strong muscle echo and complete loss of bone echo.



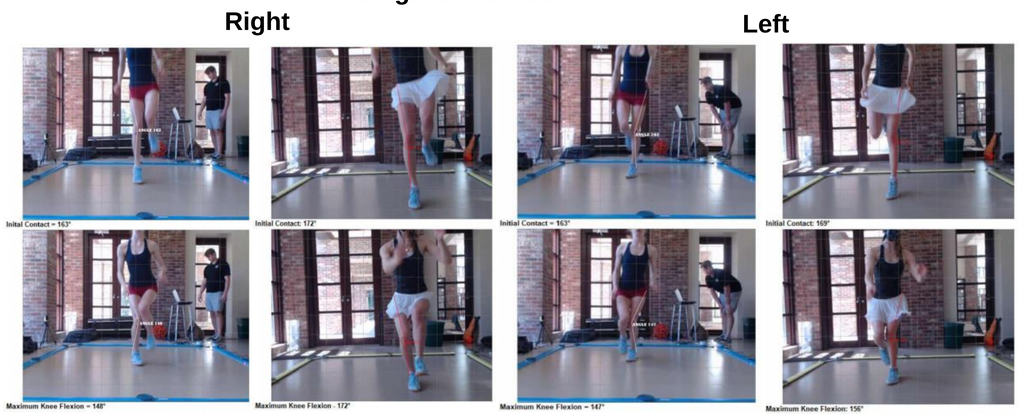
STIFFNESS-ECHOGENICITY MATRIX		ECHOGENICITY RATING 1	2	3	4
STIFFNESS RATING	A	1A Acute denervation	2A Atrophic muscle	3A Sarcopenia	4A Severe Sarcopenia
	B	1B Hypertrophic muscle	2B Normal	3B Early peripheral neurogenic	4B Early myogenic
	C	1C Densification	2C Chronic densification	3C Late peripheral neurogenic	4C Late myogenic
	D	1D Trigger Points	2D Early central neurogenic	3D Central neurogenic	4D Late central neurogenic

The **Stiffness Echogenicity Matrix** combines the stiffness rating scale and Heckmatt's echogenicity rating by ultrasound to differentiate hypoechoic muscle stiffness (e.g. due to intramuscular edema) from hyperechoic muscle stiffness (e.g. due to fibrosis) to guide treatment.[1]

Results

She reported short cramping episodes at 3 and 5 days post-injection, but overall felt less stiff with improved mobility during drills. A physical performance test by her Chiropractic physician on day 6 showed reduced bilateral stiffness in the tibialis anterior, peroneus longus and gastroc-soleus complex. Single limb heel rise test showed increased knee stability as baseline knee valgus was 15° on both sides with moderate/high risk of a non-contact knee injury. Post-injection, it improved to 0° on the right and 7° on the left.

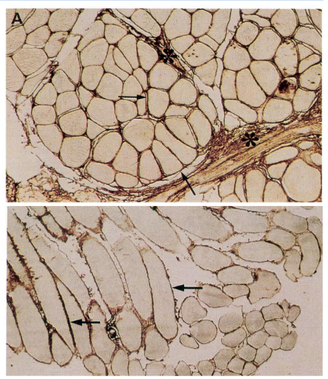
Single Limb Heel Rise Test



Discussion

The muscle extracellular matrix is rich in hyaluronic acid (HYA, stained brown with hyaluronic acid binding protein), which functions as a lubricant and facilitates force transmission. Overuse injury may lead to excessive production and accumulation of hyaluronan locally which can cause swelling (due to binding with water) and stiffness leading to chronic exertional compartment syndrome. Ultrasound demonstrated hypoechoic muscle consistent with the swelling. Excessive hyaluronan accumulation may lead to compression of structures (vessels, nerves) in the perivascular and perineural space, causing ischemic myalgia.

Posterior tibialis dysfunction leads to abnormal muscle mechanics along the entire kinetic chain, causing medial knee displacement or knee valgus,[3] and can predispose to overuse injury. Treatment must address stiffness in muscles along the entire kinetic chain, particularly in synergistically acting muscles. The enzyme hyaluronidase was used to hydrolyze the accumulated hyaluronan in stiff muscles along the kinetic chain bilaterally. It reduced muscle stiffness and also improved lower limb biomechanics as demonstrated by the single limb heel rise test. Although both sides showed a knee valgus of 15° pre-injection, the knee valgus on the right reduced to 0°, whereas it reduced to 7° on the left. The right side, however, showed lower compartment pressure (28 mmHg) compared to the left (40 mmHg), suggesting greater severity on the left. Further treatment may lead to improvement on the left.



Light micrograph of histological section of a piece of quadriceps femoris muscle obtained at surgery showing staining pattern for HYA. Endomysium and perimysium are rich in HYA (arrows). Abundant HYA is also seen in perivascular and perineural connective tissue (asterisks). [2]

Procedure

After discussion with mother and patient about risks and benefits of off-label use of hyaluronidase for muscle stiffness they consented with procedure. A brief physical exam included positive single heel rise test which reproduced symptoms, stiffness in muscles were found by palpation and noted to be tender. Prior to the procedure a preliminary skin test for hypersensitivity to HYLENEX recombinant was performed. An intradermal injection of approximately 0.02 mL (3 Units) of a 150 Unit/mL solution was injected. No erythema, itching or wheal's were noted at 5 or 20 minutes. Then intramuscular injections were performed.

Muscles injected and dose:

	Muscle injected	Side	Ultrasound rating	Stiffness rating	Volume (cc)	# Units
1	Tibialis posterior	L	-	C	1	75
2	Peroneus longus	L	1	C	1	75
3	Tibialis anterior	L	1	D	1	75
4	Lateral gastrocnemius	L	-	C	1.5	112.5
5	Sartorius	L	-	C	1	75
6	Iliopsoas	L	-	C	1	75
7	Gluteus maximus	L	-	C	1	75
8	Abductor hallucis	L	-	C	0.5	37.5
9	Tibialis posterior	R	-	C	1	75
10	Peroneus longus	R	1	C	1	75
11	Tibialis anterior	R	1	D	1	75
12	Medial gastrocnemius	R	-	C	1.5	112.5
13	Sartorius	R	-	C	1	75
14	Iliopsoas	R	-	C	1	75
15	Gluteus maximus	R	-	C	1	75
16	Abductor hallucis	R	-	C	0.5	37.5
	Total muscles: 16				**16 cc**	**1200 units**

Conclusion

- Overall our patient improved symptomatically and functionally with intramuscular injections of the enzyme hyaluronidase used to reduce muscle stiffness due to the excessive accumulation of hyaluronic acid.
- The results warrant further research into the mechanism of pain and stiffness with overuse injury and effects of treatment with hyaluronidase.

References

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2. Piehl-Aulin, K., Laurent, C., Engstrom-Laurent, A., Hellstrom, S., Henriksson, J., 1985. Hyaluronan in human skeletal muscle of lower extremity: concentration, distribution, and effect of exercise. J. Appl. Physiol. 1991: 71 (6), 2493–2498.
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