Patients with Achilles Tendinopathy show Reduced Intra-tendinous sliding during Dynamic Exercises

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Summary

Intra-tendinous sliding is lower in Achilles tendinopathy (AT) patients during isometric contractions when compared to controls, but can be increased for a similar exercise when the foot is rotated outwards ('toes-out'). However, it is not known whether the same is happening during dynamic contractions. This study compared intra-tendinous sliding between healthy subjects and AT patients during dynamic exercises and assessed the effect of foot position. Twenty participants (10 AT, 10 healthy) performed dynamic exercises (variations of heel rises-drops and squat) in neutral and toes-out foot position, with sliding measured via ultrasound and speckle tracking. Results show reduced sliding in AT patients and increased sliding in the toes-out position across both groups. These findings suggest that the toes-out position may promote healthy tendon behavior in AT patients and should be further explored as a rehabilitation option.

Introduction

The Achilles tendon consists of three subtendons originating from the triceps surae muscles. These subtendons, loaded by three muscle forces, slide relative to each other. This intra-tendinous sliding is considered to be a protective mechanism by reducing the overall stress. Previous research identified intra-tendinous sliding as a healthy tendon feature, with reduced sliding observed in AT patients during isometric contractions [1]. Interestingly, this sliding increased during "toes-out" (foot horizontally outwards rotated) contractions, suggesting a potential way to restore sliding [2]. Since isometric contractions don't reflect the tendon's dynamic daily behavior, this study compared intra-tendinous sliding between healthy subjects and AT patients and examined the effect of foot position for several dynamic exercises.

Methods

Twenty participants [10 AT, 10 healthy (both groups: 6 men, 4 women)] performed dynamic exercises, including bilateral heel rise/drop (sitting & standing), unilateral heel rise/drop (knee extended & bent) and squat. Exercises were performed in neutral and toes-out foot position, with ultrasound images captured using an external probeholder. Intra-tendinous sliding (mm) was estimated via a speckle tracking algorithm as the difference between displacement of the superficial and deep layers of the Achilles tendon.

Results and Discussion

There was a significant main effect of group ($p = 0.008$) and foot position ($p < 0.001$), indicating that: 1) AT patients show reduced intra-tendinous sliding (Table 1), and 2) the toes-out foot position increases sliding compared to neutral position (Figure 1). This increase occurred similarly in both groups, as no significant group * foot position interaction was observed.

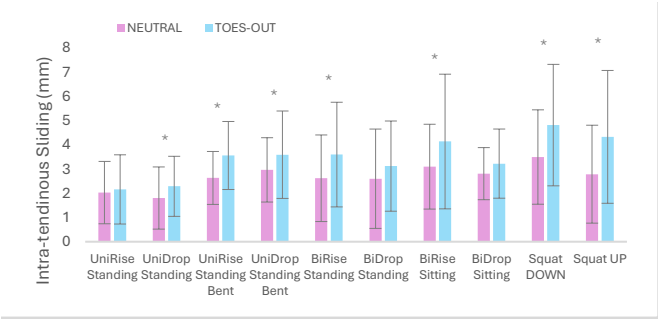

Figure 1: Intra-tendinous sliding in AT patients in dynamic exercises in neutral (purple) and toes-out (blue) foot position.

Conclusions

AT patients show reduced intra-tendinous sliding during dynamic exercises. Regardless of the group, this sliding was increased in the toes-out position compared to the neutral foot position, indicating a potential strategy to encourage healthy Achilles tendon behavior. Future studies should investigate whether implementing this foot position in rehabilitation programs can enhance intra-tendinous sliding and improve symptoms.

Acknowledgments

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References

[1] Lecompte L et al. (2024) *J Med Sci Sports*, **34**: e14679.
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Table 1: Intra-tendinous sliding (mm) in neutral foot position during dynamic exercises in AT patients and healthy subjects.

	Unirise	Unidrop	Unirise Bent	Unidrop Bent	Birise standing	Bidrop Standing	Birise Sitting	Bidrop Sitting	Squat Down	Squat Up
AT	2.15 ± 1.30	1.90 ± 1.33	2.72 ± 1.12	3.04 ± 1.39	2.83 ± 1.77	2.80 ± 2.07	3.10 ± 1.75	2.81 ± 1.08	3.83 ± 1.73	2.97 ± 2.05
Healthy	4.14 ± 1.42	3.81 ± 1.14	4.78 ± 2.63	5.65 ± 2.41	4.89 ± 1.46	3.94 ± 0.99	4.12 ± 1.38	3.52 ± 1.01	5.96 ± 2.62	5.12 ± 2.12
p-value	***0.011****	***0.009****	*0.051*	***0.016****	***0.025****	*0.204*	*0.226*	*0.198*	*0.071*	*0.062*