

The purpose of this document is to summarize common medical and surgical interventions which may be considered for the management of Achilles tendinopathy – particularly if it is not responding adequately to more strongly supported conservative management strategies (see “*Achilles Tendinopathy: Summary of the Evidence for Physical Therapy Interventions*”).

Pharmacological Approaches

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
NSAIDs	Short term benefit in the acute stage of tendinopathy to minimize inflammatory process.	Interrupts the chemical pathway of inflammation.	PROS: <ul style="list-style-type: none"> Inexpensive, easily accessible. 	Limited evidence for a modest effect of topical or oral NSAIDs in acute stage in Achilles tendinopathy.	PTs are involved in the treatment of tendon pain at all stages of recovery. General knowledge of commonly used NSAIDs is important for treatment planning.
			CONS: <ul style="list-style-type: none"> Precautions and contra-indications that accompany specific medications. Inhibition of inflammation may delay repair of muscle tissue or tendon insertion. 		
References: McLauchlan, G, Handoll, H. (2009). Interventions for treating acute and chronic Achilles tendinitis. <i>Cochrane Collaboration of Systemic Reviews</i> . 2:1-36. Karlsson, J., Brorsson, A., & Silbernagel, K. (2014). Treatment of Chronic Achilles Tendinopathies. In G. Bentley (Ed.), <i>European Instructional Lectures</i> (Vol. 14, pp. 191-200): Springer Berlin Heidelberg.					
Corticosteroid (injection)	Short-term benefit in acute stage. In chronic tendinopathy, the rationale for the use of anti-inflammatory injections is controversial.	Injection into the paratendon to interrupt the inflammatory process.	PROS: <ul style="list-style-type: none"> Easily accessible. Careful administration outside the structure of the tendon is considered ‘safe’ i.e., in the paratendon sheath. 	There is a lack of high quality evidence to support the use of local corticosteroid injections in chronic Achilles tendon lesions. Generally, lack of well-designed clinical trials.	PTs are involved in the treatment of tendon pain at all stages of recovery. There are animal studies that suggest risk of tendon rupture after corticosteroid injection. Caution is recommended in progressing the loading of the tendon within two weeks of a corticosteroid injection (exercise precautions).
			CONS: <ul style="list-style-type: none"> Risk of infection (1%) Destructive; risk of tendon rupture; impairs tendon tissue repair mechanism. 		
References: DaCuz, D, Geeson, M, Allen, M, Phair, I. (1988). Achilles paratendonitis: an evaluation of steroid injection. <i>British Journal of Sports Medicine</i> . 22(2): 64-65. Shrier, I, Matheson, G, Kohl, G. (1996). Achilles tendinitis: are corticosteroid injections useful or harmful? <i>Clinical Journal of Sports Medicine</i> . 6(4): 245-250. Fredberg, U. (1997). Local corticosteroid injection in sport: a review of literature and guidelines for treatment. <i>Scandinavian Journal of Medicine and Science In Sports</i> . 7(3): 131-139. Speed, C. (2001). Corticosteroid injections in tendon lesions. <i>British Medical Journal</i> . 323: 382-386.					

Pharmacological Approaches (continued)

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Glycerol Trinitrate (GTN)	Nitro-glycerine patches applied over tendon to enhance healing.	Nitric oxide may increase blood flow to the tendon and stimulate repair by enhancing fibroblast proliferation.	<p><i>PROS:</i></p> <ul style="list-style-type: none"> • GTN may improve outcomes compared to exercise alone. • Increased compliance because of ease of application. Self-applied. • Non-invasive. 	Conflicting evidence limits conclusions and widespread use.	If prescribed by a physician may be applied by a physiotherapist and used in conjunction with an eccentric exercise program.
			<p><i>CONS:</i></p> <ul style="list-style-type: none"> • Labour- intensive; requires repeated applications over 12 weeks. • Potential headache as a side-effect of nitro patch. 		
<p>References:</p> <p>Paoloni, J, Appleyard, R, Nelson, J, Murrell, G. (2004). Topical GTN treatment of chronic non-insertional Achilles tendinopathy. A randomized, double-blind, placebo-controlled trial. <i>Journal of Bone and Joint Surgery - America</i>. 86-A(5): 916-922.</p> <p>Hunter, G, Lloyd-Smith, R. (2005). Topical GTN for chronic Achilles tendinopathy. <i>Clinical Journal of Sports Medicine</i>. 15(2): 116-117.</p> <p>Paolini, J, Murrell, G. (2007). Three year follow-up study of topical GTN treatment of chronic non-insertional Achilles tendinopathy. <i>Foot and Ankle International</i>. 28(10): 1064-1068.</p> <p>Kane, T. P., Ismail, M., & Calder, J. D. (2008). Topical glyceryl trinitrate and noninsertional Achilles tendinopathy: a clinical and cellular investigation. <i>Am J Sports Med</i>, 36(6), 1160-1163. doi: 10.1177/0363546508314423</p> <p>Gambit, E, Gonzalez-Suarez, C, Oquinena, T, Agbyani, R. (2010). Evidence on the effectiveness of topical nitroglycerin in the treatment of tendinopathies: a systemic review and meta-analysis. <i>Archives of Physical Medicine and Rehabilitation</i>. 91(8): 1291-1305.</p>					

Injection Therapies

Chronic Achilles tendinopathy is associated with abnormal proliferation of neovessels in the ventral portion of the tendon, and along with accompanying neural tissue, is associated with pain in tendinopathy. The presence of neovessels can be visualized by use of ultrasound (US) (sonography). Grey-scale US is a reliable method to assess tendon structure. Color Doppler or power Doppler has also been used to visualize blood flow.

Conservative treatment for Achilles tendinopathy is unsuccessful in 24-45% of cases. US-guided injections are becoming increasingly considered as part of 'best practice' for treatment of tendinopathies that have failed to respond to other conservative treatment.

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Polidocanol	Originally developed as an anaesthetic, and widely used as a sclerosing agent in the treatment of varicose veins.	There is a body of literature that supports the use of US-guided injections of polidocanol to disrupt neovessels and accompanying nerve structures associated with chronic tendinopathy.	<p><i>PROS:</i></p> <ul style="list-style-type: none"> Increasingly used, registered drug with few side-effects. No need to use additional anaesthetic, as it has its own aesthetic properties. 	Conflicting evidence limits conclusions and widespread use.	PTs should have knowledge of more invasive techniques to help to facilitate referral of patients to other procedures when conventional treatment fails to result in a sufficient positive response.
			<p><i>CONS:</i></p> <ul style="list-style-type: none"> Expensive sonography equipment, requiring an experienced operator. 		

References:

- Ohberg, L, Alfredson, H. (2002). US-guided sclerosis of neovessels in painful chronic Achilles tendinosis: pilot study of new treatment (original article). *British Medical Association*. p 1-7.
- Alfredson, H, Ohberg, L. (2005). Sclerosing injections to areas of neovascularization reduces pain in chronic Achilles tendinopathy: a double-blinded randomized trial. *Knee Surgery, Sports Traumatology, Arthroscopy*. 13:338-344.
- Alfredson, H, Ohberg, L, Zeisig, E, Lorentzan, R. (2007). Treatment of mid-portion Achilles tendinosis: similar clinical results with US and CD-guided surgery outside the tendon and sclerosing polidocanol injections. *Knee Surgery, Sports Traumatology, Arthroscopy*. 15:1504-1509.
- Willberg, L, Sunding, K, Ohberg, L, Forssblad, M, Fahlstrom, M, Alfredson, H. (2008). Sclerosing injections to treat mid-portion Achilles tendinosis: a randomized controlled study evaluating two different concentrations of polidocanol. *Knee Surgery, Sports Traumatology, Arthroscopy*. 16:859-864.
- Wijesekera, N, Chew, N, Lee, J, Mitchell, A, et al. US-guided treatment for chronic Achilles tendinopathy: an update and current status. (2010). *Skeletal Radiology*. 39:425-434.
- van Sterkenburg, M, Jonge, M. (2010). Less promising results with sclerosing ethoxysclerol (polidocanol) injections for mid-portion Achilles tendinopathy. *American Journal of Sports Medicine*. 38(11):2226-2232.

Injection Therapies (continued)

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Prolotherapy	Injecting a small volume of an irritant solution at multiple sites around a tendon insertion to induce a 'pro-inflammatory' proliferative cell response. One study used hyperosmolar dextrose while another used hypertonic glucose, both with a small amount of anaesthetic.	Fibroblast proliferation, collagen maturation and resolution of neovessels are observed, with near normal appearance of tendon tissue structure observed with US. New viable tissue hypothesized to result from local release of cell growth factors. Medical dextrose also has a weak sclerosing effect on vessels.	<i>PROS:</i>	Limited evidence suggests that prolotherapy combined with eccentric exercise for Achilles tendon loading may provide more rapid improvement in symptoms than eccentrics alone, although long-term VISA-A scores are similar.	Prolotherapy may enhance outcomes compared to using eccentric exercise, alone.
			<ul style="list-style-type: none"> Can be performed with or without US-guided localization. 		
			<i>CONS:</i>		
			<ul style="list-style-type: none"> Not covered by medical plans (BC); usually requires a private fee that reflects the expertise of the practitioner. Requires three or more repeated treatments. 		

References:

Ryan, M, Wong, A, Taunton, J. (2010) Favorable outcomes after US-guided intertendinous injection of hyperosmolar dextrose for chronic insertional and mid-portion Achilles tendinitis. (Original research). *American Journal of Roentgenology*. 194: 1047-1053.

Wijesekera, N, Chew, N, Lee, J, Mitchell, I A, et al. (2010). US-guided treatment for chronic Achilles tendinopathy: an update and current status. *Skeletal Radiology*. 39:425-434.

Yelland, M. J., Sweeting, K. R., Lyftogt, J. A., Ng, S. K., Scuffham, P. A., & Evans, K. A. (2011). Prolotherapy injections and eccentric loading exercises for painful Achilles tendinosis: a randomised trial. *Br J Sports Med*, 45(5), 421-428. doi: 10.1136/bjism.2009.057968

Platelet Rich Plasma (PRP) and Autologous whole blood	Autologous blood injections involve the reinjection of a patient's own whole blood. In PRP the autologous blood is centrifuged to collect a concentrate of the platelets and plasma. This is then injected back into the patient's tendon.	Cellular and humoral (blood) mediators promote healing in areas of tendon degeneration.	<i>PROS:</i>	Two high-quality RCTs have shown both PRP and autologous whole blood injection to be ineffective.	PTs are part of a treatment team when treating tendon injury. General knowledge of PRP and relevant high quality RCTs is important to assist patients in decision-making.
			<ul style="list-style-type: none"> Non-surgical option Can be performed with or without US-guided localization 		
			<i>CONS:</i>		
			<ul style="list-style-type: none"> RCT-level evidence of lack of effectiveness Requires expensive blood processing equipment and centrifuge. 		

References:

De Vos, R, Weir, A, et al. (2010). PRP injection for chronic Achilles tendinopathy. *Journal of the American Medical Association*. 303(3): 144-149.

Engelbrechtsen, L, Steffen, K, et al. (2010). IOC consensus paper on use of PRP in sports medicine. *British Journal of Sports Medicine*. 44(15): 1072-1081.

Wijesekera, N, Chew, N, Lee, J, Mitchell, A, et al. (2010). US-guided treatment for chronic Achilles tendinopathy: an update and current status. *Skeletal Radiology*. 39:425-434.

De Jonge, S, de Vos, R, Weir, A, et al. (2011). 1-year follow-up of PRP treatment in chronic Achilles tendinopathy: a double-blind random placebo-controlled trial. *American Journal of Sports Medicine*. 39(8): 1623-1629.

Bell, K. J., Fulcher, M. L., Rowlands, D. S., & Kerse, N. (2013). *Impact of autologous blood injections in treatment of mid-portion Achilles tendinopathy: double blind randomised controlled trial* (Vol. 346).

Injection Therapies (continued)

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
High volume injection(HVI) or Hydrostatic dissection	Small volume of anaesthetic/steroid and high volume of saline, delivered by US-guided imaging.	The pressure created by the volume of substance into the tendon sheath is proposed to disrupt the neovessel ingrowth in Achilles tendinopathy.	<p><i>PROS:</i></p> <ul style="list-style-type: none"> • Non-surgical option. <p><i>CONS:</i></p> <ul style="list-style-type: none"> • Requires sonography equipment. 	Limited evidence of effectiveness.	Potential treatment option for Achilles tendinopathy that has failed to respond to a more conservative approach.
<p>References:</p> <p>Chan, O, O'Dowd, D, Padhiar, N, et al. (2008). High volume image guided injections in chronic Achilles tendinopathy. <i>Disability and Rehabilitation</i>. 30: 1697-1708.</p> <p>Maffulli, N., Spiezia, F., Longo, U. G., Denaro, V., & Maffulli, G. D. (2013). High volume image guided injections for the management of chronic tendinopathy of the main body of the Achilles tendon. <i>Physical Therapy in Sport</i>, 14(3), 163-167. doi: http://dx.doi.org/10.1016/j.ptsp.2012.07.002</p> <p>Boesen, A., Boesen, M., Hansen, R., Malliaras, P., Chan, O., & Langberg, H. (2014). 61 High Volume Injection, Platelet Rich Plasma And Placebo In Chronic Achilles Tendinopathy—A Double Blind Prospective Study. <i>British Journal of Sports Medicine</i>, 48(Suppl 2), A39-A40.</p>					

Dry Needling

The term 'dry needling' has been used to describe several techniques that involve insertion of a needle without injection of a substance. Needling of the tendon has been described by a number of practitioners using a hypodermic needle. Similar results using acupuncture needles have become more common. The technique is described below.

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Dry Needling using a Hypodermic Needle ('tendon fenestration')	Tissue trauma from the cutting edge of the needle/lumen.	Repeated lancing of abnormal tendon tissue creates haemorrhage followed by an inflammatory response, granulation and healing. Some needling techniques employ US to guide the needle (percutaneous needle tenotomy).	<p><i>PROS:</i></p> <ul style="list-style-type: none"> • Invasive treatment that avoids full surgical exposure and risks. <p><i>CONS:</i></p> <ul style="list-style-type: none"> • Requires sonography equipment. • Potential to permanently injure the tendon 	Limited evidence of effectiveness,	An invasive treatment with limited evidence.

References:

Housner J, Jacobsen J, Misko R. (2009). Sonographically guided percutaneous needle tenotomy for treatment of chronic tendinosis. *Journal of Ultrasound Medicine*. 28(8): 1187-1192.

Surgical Approaches

Surgical success rates are reported at 85% for Achilles tendinopathy that have failed to respond to conservative measures.

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Percutaneous tenotomy	Techniques include closed dissection of the tendon sheath by US-guided percutaneous longitudinal internal tenotomy; or open surgical exposure of the tendon.	Surgical trauma creates granulation and repair, and interrupts fibrous adhesions.	PROS: <ul style="list-style-type: none">• Simple procedure that can be done as an outpatient.	Satisfactory outcomes for selected patients that do not have complicated Achilles pathology, and have failed to respond to a conservative treatment approach. Treatment seems to be effective in the long-term with regard to returning to pre-injury level of functioning. Paratendinopathy is a negative prognostic factor.	PT may be involved in the post-op rehabilitation following surgery.
			CONS: <ul style="list-style-type: none">• Risk of infection.		

References:

Maffulli, N., Oliva, F., Testa, V., Capasso, G., & Del Buono, A. (2013). Multiple Percutaneous Longitudinal Tenotomies for Chronic Achilles Tendinopathy in Runners A Long-Term Study. *The American journal of sports medicine*, 41(9), 2151-2157.

Testa, V, Capasso ,G, Benazzo, F, Muffulli, N. (2002). Management of Achilles tendinopathy by US-guided percutaneous tenotomy. *Medicine and Science in Sports and Exercise*. 34(4): 573-580.

Surgical Debridement	Central longitudinal incision to expose the tendon, with excision of disorganized and fibrotic tendon tissue and adhesions. Additional diathermy to destroy neovessels.	Surgery creates granulation and repair, and removes fibrotic tissue.	PROS: <ul style="list-style-type: none"> High success rates reported by some centres in terms of reducing pain and improving functionality. 	Surgery may be a successful option for patients that have failed to respond to conservative treatment, or have complicated Achilles tendon pathology.	PT may be involved in the post-op rehabilitation following surgery.
			CONS: <ul style="list-style-type: none"> Risk of infection. Long post-op recovery of 3-6 months. 		
References: Maffulli, N., Del Buono, A., Testa, V., Capasso, G., Oliva, F., & Denaro, V. (2011). Safety and outcome of surgical debridement of insertional Achilles tendinopathy using a transverse (Cincinnati) incision. <i>Journal of Bone & Joint Surgery, British Volume</i> , 93(11), 1503-1507. Tallon, C, Coleman, B, Khan, K, Maffulli, N. (2001). Outcomes of surgery of chronic Achilles tendinopathy. <i>American Journal of Sports Medicine</i> , 29(3): 315-320.					

Surgical Approaches (continued)

Intervention	Method	Proposed Mechanism	Benefit: Pros/Cons	Evidence	Take Home Message Implications for Physiotherapy
Minimally invasive stripping	Small incision is made allowing a probe or scalpel to be inserted ventral to the tendon. The area of neovascularisation is stripped.	Disrupts abnormal blood/nerve supply, releases adhesions.	PROS: <ul style="list-style-type: none"> High success rates reported. Minimal trauma to tendon. Quick return to sport. Reduced risk of infection comparing to open surgery 	Retrospective, short-term studies only.	PT may be involved in the post-op rehabilitation following surgery.
			CONS: <ul style="list-style-type: none"> Risk of infection. Potential loss of gliding function due to long term increased fibrosis around tendon. 		
References: Longo UG, Ramamurthy C, Denaro V, Maffulli N. Minimally invasive stripping for chronic Achilles tendinopathy. <i>Disabil Rehabil</i> . 2008;30(20-22):1709-13.					

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