Subcutaneous prolotherapy for Achilles tendinopathy: The best solution?

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Abstract

Subcutaneous prolotherapy is an effective treatment for Achilles tendinopathy in the primary care setting. Different glucose/local anesthetic concentrations were clinically trialed over a four-year period with long-term follow up of 132 Achilles tendons. All 169 Achilles were prospectively monitored with an evidence-based Recovergram and 132 Achilles were independently followed up after a mean period of 20 months. Mean follow up VAS was 0.4 and 90% of patients were satisfied with treatment.

All solutions were effective at follow up.

Introduction

Symptomatic mid Achilles tendinopathy has long been viewed as a difficult condition to treat but several effective medical treatments are now emerging. These include eccentric strength exercises according to Alfredson and Ohberg,[1] ultrasound (US) guided sclerosing injections with polidocanol,[2] glyceryl trinitrate treatment,[3,4] autologous blood,[5] and subcutaneous prolotherapy.[6] The highest level of evidence is for glyceryl trinitrate treatment.

However, a two-year follow up study on US guided polidocanol injections was published by Alfredson and Ohberg[7] in December 2006, introducing objective ultrasound/color Doppler criteria for the long-term evaluation of treatment effect in addition to VAS and patient satisfaction scores. They assessed in 42 Achilles tendons a reduction of VAS from 75 to 7, with a patient satisfaction rate of 88%. They measured a significant reduction in tendon volume, "more normal structure", and "no or few remaining neovessels" on ultrasound color Doppler imaging. These objective imaging parameters are promising as well as economical monitoring tools for future research in setting a gold standard for treatment interventions.

The author's subcutaneous prolotherapy evaluation of 169 Achilles tendons over four years with long-term follow up of 132 Achilles tendons is a Level 4 clinical evidence-based, patient-centered, outcome-focused study.

Increasing concentrations of hypertonic glucose were used over three consecutive years on the recommendation of a leading researcher with the purpose of increasing the effectiveness of the postulated sclerosing effect of hypertonic glucose.

Methods

All patients presenting at a sports medicine and rehabilitation clinic requesting prolotherapy for mid Achilles tendinopathy were treated by a general practitioner experienced in subcutaneous prolotherapy.

The patients were prospectively monitored at each treatment session with a Recovergram.[8]

The Recovergram monitored VAS 0-10 (0 = no pain, 10 = worst imaginable pain) and Limitation of Activities with a Disability Rating of 0 = no limitation, 1 = can do slightly limited, 2 = can do with difficulty, 3 = can't do at all.

After identifying the most tender points (TPs) all patients were treated with subcutaneous injections at each TP with 0.5-1 ml of hypertonic glucose and local anesthetic, taking great care to avoid the paratenon or tendon proper.

Treatments were given at weekly intervals where possible.

The following glucose/LA concentrations were used.

- In 2004-2005: glucose 20%/lignocaine 0.1%.
- In 2006: glucose 30%/lignocaine 0.1%/ropivacaine 0.1%.
- In 2007: glucose 40%/ropivacaine 0.1%.

Follow up was conducted by an independent party with a standard questionnaire assessing follow up VAS (0-10) and "satisfied with treatment" rating Yes or No.

Individual Recovergrams were collated into a "Study Recovergram" for separate years, reflecting the mean response to treatment for males and females. The mean was calculated for age, length of symptoms, length of treatment, initial VAS and VAS, and satisfaction rates at follow up.

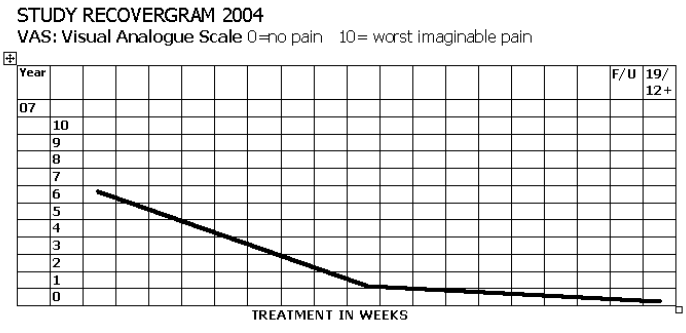

Figure 1. Study Recovergram 2004

2004 (4 months) Glucose 20%/Lignocaine 0.1%.

Male tendons	15 (1 bilateral)
Female tendons	4 (2 bilateral)
Mean age	49 years
Mean length of symptoms	5 years.
Mean length of treatment	7.8 weeks
Mean initial VAS	6.6
100% follow up at two years	
Mean VAS at follow up	0.18
Satisfied with treatment	100 %

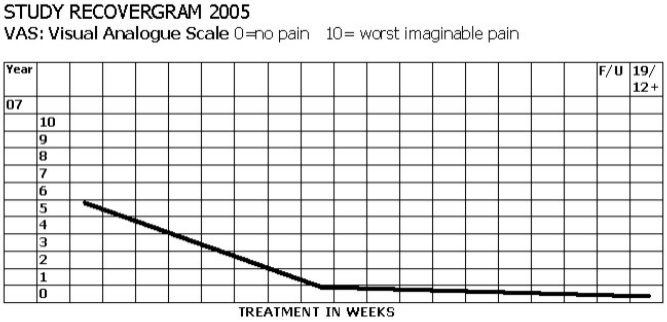

Fig 2 Study Recovergram 2005 males

2005 20% Glucose/Lignocaine 0.1%	
Male tendons	50 (4 bilateral)
Mean age	47 years
Mean length of symptoms	17 months
Mean initial VAS	5.8
Mean length of treatment	7.6 weeks
77 % follow up at mean 19 months	
Mean VAS at follow up	0.4
Satisfied with treatment	94%

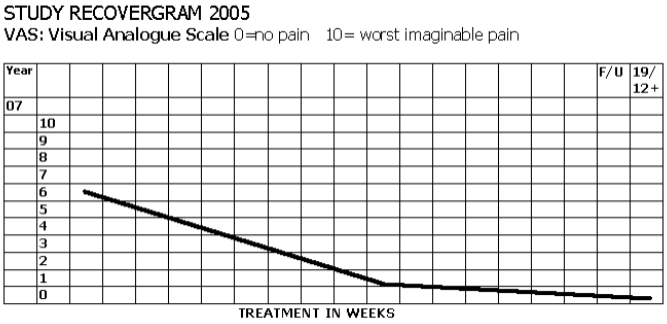

Figure 3. Study Recovergram 2005 females

2005 Glucose 20%/Lignocaine 0.1%	
Female tendons	29 (4 bilateral)
Mean age	47 years
Mean length of symptoms	17 months
Mean initial VAS	6.5
Mean length of treatment	8.5 weeks
77 % follow up at mean 20 months	
Mean follow up VAS	0.25
Satisfied with treatment	94 %

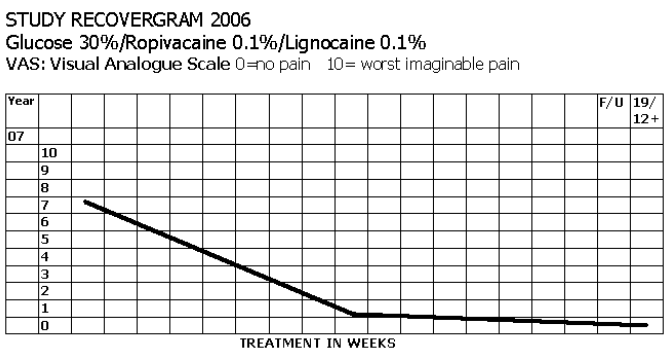

Figure 4. Study Recovergram 2006

2006 Glucose 30%/ Ropivacaine 0.1%/ Lignocaine 0.1%	
Male tendons	16 (1 bilateral)
Female tendons	18 (2 bilateral)
Mean age47 years	(28-69)
Mean length of symptoms	14 months (1-60)
Mean length of treatment	7.6 weeks (3-15)
Mean initial VAS	6.7
Mean VAS at last treatment	1.1
84 % follow up at mean 12 months	
Mean VAS at follow up	0.6
Satisfied with treatment	88 %

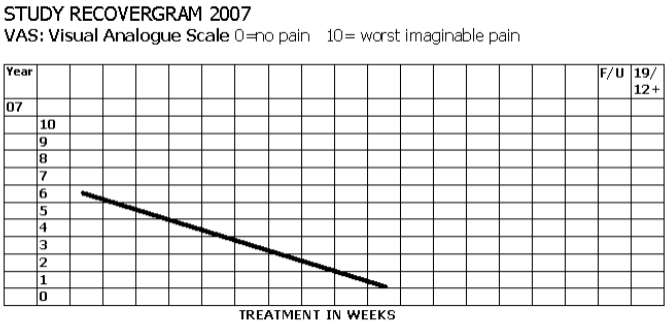

Figure 5. Study Recovergram 2007

2007 Glucose 40%/Ropivacaine 0.1 %	
Male tendons	11 (1 bilateral)
Female tendons	26 (10 bilateral)
Mean age	49
Mean length of symptoms	35 months
Mean length of treatment	8.7 weeks
Mean initial VAS	6.7
Mean VAS at last treatment	1.1

Discussion

The role of the peripheral nervous system in tissue maintenance and renewal during normal function, as well as repair following injury through a *peptidergic noceffector* mechanism was postulated by L Kruger et al.[10] from UCLA as far back as 1989.

Their seminal paper on the peripheral patterns of Calcitonin Gene Related Peptide (CGRP) immuno-reactivity in the peripheral tissues of rats is illuminating in that it allows for appreciation of the close connection between repair and nociception.

A more recent study on the role of the peripheral nervous system in healing of rat Achilles tendon was published by P Ackerman et al.,[11] which concluded: "It may prove that the observed temporal occurrence of different neuropeptides reflects a role of the peripheral nervous system in regulating synchronously nociception and repair".

They found that after acute tendon injury the ingrowth of Substance P (SP) and CGRP positive fibers, already seen at weeks 1-2, was associated with increased nociception. In nociception it has been well documented that CGRP

potentiates the effect of SP. Subsequent occurrence of Galanin (GAL) positive fibers was associated with decreased nociception.

It appears that normal repair with regression of nerve ingrowth and declining levels of peptidergic neuropeptides is not occurring in tendinopathies.

Alfredson and Ohberg[9] studied chronic painful Achilles tendinopathies with biopsies and in-vivo microdialysis and found high levels of SP and CGRP closely associated with neovessels.

Sclerosing of proliferating neovessels with US guided polidocanol injections was postulated by Alfredson and Ohberg[2] to offer an avenue for repair and subsequent reduction of pain. Their excellent results confirm the connection between neovessels and nociception.

Other researchers have found high levels of the key angiogenic mediator Vascular Endothelial Growth Factor (VEGF).[12]

It has been known for some time that VEGF prevents apoptosis and senescence of cells.[13] The physiological balance between proliferation and apoptosis is crucial for tissue health. Apoptosis is best viewed as the process that determines the quality and quantity of cells.

Unchecked proliferation through suppression of apoptosis of neovessels, nociceptors and tendinosis cells is the essence of tendinopathy/tendinosis.

It is well documented that hypertonic glucose induces apoptosis and this is the postulated mode of action for subcutaneous prolotherapy. Hypertonic glucose injections target the peptidergic noceffectors which are predominantly located perivascularly under the dermal papillae, with consistent benefits for nociception.

In summary, the demonstrated excellent results of subcutaneous prolotherapy in Achilles tendinopathy in this study confirm it as a safe and effective treatment of painful tendons with good long-term outcomes.

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