Physical Medicine & Rehabilitation Journal

SCIENTIFIC LITERATURE

Research Article

Eccentric Exercises for Achilles Tendinopathy: Predicting Treatment Outcomes and selecting those who will benefit

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ARTICLE INFO

Received Date: August 03, 2022
Accepted Date: August 29, 2022
Published Date: August 31, 2022

KEYWORDS

Achilles tendinopathy
Eccentric exercises
Predicting outcome
Predictive modelling

Citation for this article: Anne-Marie Hutchison, Owen Bodger, Claire Topliss, Paul Williams, Jonathan Neathey and David Beard. Eccentric Exercises for Achilles Tendinopathy: Predicting Treatment Outcomes and selecting those who will benefit. Physical Medicine & Rehabilitation Journal. 2022; 4(2):129

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ABSTRACT

Purpose: To identify patients who are unlikely to response to Eccentric Exercises (EE) for Achilles tendinopathy.

Methods: The prognostic model utilised data from 158 Achilles tendinopathy patients from an NHS heel pain clinic who completed a 12 week EE program. Multivariable logistic regression was used to develop the model and identify the significant predictors of outcome of treatment. The model's accuracy and predictive capabilities were assessed for use in the clinical setting.

Results: Only 34% of patients achieved treatment success with eccentric exercises. Pre-intervention patient-reported measurements of severity (VAS and VISA-A) were most highly correlated with treatment outcome. The probability of success ranged from 10% (in all patients) to 75% in patients with a low VAS score (20 or less).The final model accounted for the capability for patients to complete EE.

Conclusion: A prediction model identified patients least likely to benefit from eccentric exercises, a common treatment for Achilles tendinopathy.More severe symptoms were associated with a lower chance of success.The process facilitates clinical management by enabling direct referral to subsequent, potentially more effective treatments thereby reducing the time and cost of overall treatment.

INTRODUCTION

Achilles tendinopathy is characterised by pain and stiffness in the Achilles tendon [1]. It is a common pathology, affecting approximately 150,000 people in the UK each year [2]. Although not fully understood the pathology is thought to occur because of degeneration and a failed healing response of the tendon [3,4]. A more recent theory by Cook and Purdam (2009) suggests that the tendon pathology goes through different stages, reactive, disrepair and degenerative [5]. Whilst the pathology is not fully understood it is likely that the condition will remain difficult to treat. Many modalities are used in the management of this tendon pathology and new innovative treatments are frequently emerging [6]. Patients and clinicians have a range of non-operative treatment options such as exercise, insoles, electrotherapy and injections at their disposal. Surgery is usually only considered if conservative treatments fail [7-9]. While there is no consensus among orthopaedic clinicians regarding the best treatment for an Achilles tendinopathy, many authors recommend exhausting conservative treatment options before proceeding to surgery. A hierarchy model of treatment is often used with patients slowly progressing through different approaches on the aforementioned "trial and error" basis. The hierarchy understandably utilises less

invasive and less expensive treatments early in the pathway moving to more expensive and more invasive (hence higher risk) treatments later in the pathway. Often physiotherapy and EE are trialled before ESWT, injection therapies and finally surgery is considered[10]. Eccentric Exercise (EE) therapy is currently the most dominant conservative treatment therapy used for patients with a chronic Achilles tendinopathy and a number of guidelines [8,11-13] have recommended that eccentric exercises should be considered as the first line of treatment. An advantage of an eccentric treatment programme is that it does not involve costly equipment. The disadvantages are it is time consuming (recommended to be carried out over 8–12 weeks); painful; relies on patient compliance; and is difficult to apply for patients with bilateral symptoms (since the patient is meant to toe raise on the non-painful leg, this is impossible to do when both legs are painful). In addition, studies which have investigated EE demonstrate inconsistencies in results. The concept of eccentric exercises as a treatment for Achilles tendinopathy has been described by Stanish et al. [14]. The treatment is based on the belief that tendon injuries often occur during the eccentric phase of muscle work. The mechanisms behind the effects of eccentric exercises are not fully understood but may either directly affect tendon pathology or prepare the muscle for better function [14]. Although eccentric exercises were introduced in 1986 by Stanish et al., they started to dominate in the literature after the first prospective study was published by Alfredson et al. in 1998 [15]. Alfredson et al. examined 30 patients who had failed conservative treatment and were awaiting surgery for a chronic mid-body Achilles tendinopathy. Fifteen of the patients conducted a 12-week programme of eccentric exercises and 15 patients received a 12-week period of no treatment followed by surgical treatment. A significant decrease in pain during activity and significant increase in calf strength was reported in both groups, the authors concluded 'we strongly suggest that this training model be properly tried before surgical invention is instituted'. The study increased the popularity of eccentric exercises substantially but questions remain over the correct interpretation. No analysis was performed to determine if a difference between the groups existed. We conducted a review of the literature to determine the effectiveness of eccentric exercises; only randomised controlled trials were included [6].Just nine studies were identified which include exercises as part of the treatment intervention, only four studies have tested the efficacy of an eccentric exercise programme alone against another intervention; an air cast brace[16] SWT, [17,18] concentric exercises[19]. All the authors concluded that eccentric exercises showed good results, only one of the studies, Mafi et al. [19] showed a significant difference between the groups in favour of the eccentric exercises over another intervention (concentric exercises) during the study period ($P < 0.002$). Silbernagel et al. [20] compared a progressive tendon loading exercise programme consisting of eccentric and concentric exercises carried out 4 days a week for 8–12 weeks under the supervision of a physio- therapist with a control group who carried out stretches and toe raises. Nine outcome tools were used in this study, and as part of the study, the reliability of each was investigated. No significant differences were found between the groups for any of the outcomes apart from physical activity and pain level which was measured by a follow-up questionnaire at 1 year. This inconsistency and inability to predict outcome with EE presents difficulties from a clinical management perspective.On the one hand it is sensible to utilise lower level modalities as some patients will benefit, on the other, it could present delays, inefficiencies and a potential waste of resources. One reason for the inconsistencies regarding the effectiveness of EE may be related to individual patients, each patient may have characteristics that might affect the likelihood of outcome of success with EE treatment. If patient characteristics are related to outcome then a prognostic model could be developed to help guide clinicians on the likelihood of success of an EE at an individual level.

Aims of the study

The aims of this study were twofold; 1. To determine whether the outcome of EE treatment for Achilles tendinopathy is predictable using easily available patient data 2. To construct and validate a simple predictive model identifying patients unlikely to benefit from treatment.

MATERIALS AND METHODS

Data source

Over a 4-year period (between June 2015 and July 2019), all patients who attended the heel pain clinicwith a clinical diagnosis of a chronic Achilles tendinopathy, a minimum three-

month history of pain were prescribed a 12 week EE program. This was a pragmatic study of clinical practice so all patients were included regardless of co-morbidities. Clinically diagnosis was confirmed via the patient complaining of pain / tenderness in the tendo Achilles between 2 cm and 6 cm above its insertion into the calcaneum or at the insertion into the calcaneusas well as pain on palpation of these areas [21]. Three month plus duration of pain was chosen since during the initial stage of the tendon injury the "reactive phase", it is recommended that load on the tendon is reduced [5]. Patients with a mid-body Achilles tendinopathy were instructed the 12 week Alfredson EE program [15] and patients who had an insertionaltendinopathy were instructed on the Jonsson EE program [22]. The patients were instructed on the program and given a patient information sheet in addition to a diary to document their compliance. The Alfredson program and Jonsson program Tables 1 and 2. Patients were monitored at regular intervals throughout the EE program (start of program, 2 weeks, 6 weeks and 12 weeks) by specialist physiotherapists and a podiatrist in the heel pain clinic.They were monitored to check the accuracy of performing the exercises. The following patient demographic data was collected at baseline as well as outcomes and PROM data collected at baseline and 12 weeks.

1. Discharge on completion of treatment. Several categories of outcome were recorded. We reduced these to a binary outcome, with patient discharge being defined as successful treatment. Where patients continued onto further treatment, were unable or unwilling to complete treatment or were referred to a consultant for further examination the treatment was classified as unsuccessful. No patient was discharged who had not attained sufficient benefit hence patients were only discharged if they reported satisfaction and had returned back to their previous tendon loading activities without problem.Patients who did not achieve benefit were not discharged but referred for different treatment higher up the treatment hierarchy.The next treatments were offered in order of how invasive they were, that is patients were offered ESWT, followed by injection therapy and finally a refer with an orthopaedic surgeon for consideration of surgery.

2. The Victoria Institute of Sport Assessment –Achilles (VISA-A) questionnaire (shown to be validated and reliable outcome measure for this condition) [23].

3. Visual Analogue Scale (VAS) for pain (the average it has been over the previous week) [24].

4. A further variable thought to potentially influence outcome is the quality or capability of the patient to perform eccentric exercises correctly, Eccentric Exercise Quality (EEQ). Patients in the sample were ascribed either a) Normal (good quality and capable) or b) Modified (where unable to lower on one leg because of a bilateral problem or other MSK problems) for Eccentric Exercise Quality (EEQ).

5. Demographic data was collected on gender, age, duration of symptoms, unilateral or bilateral symptoms, side of body affected (left / right), location of pain (tendon body, insertion or both) andwhether insoles were issued to address foot posture abnormalities.

Table 1: Alfredson heel-drop exercise programme for mid body tendinopathy.

Summary of Alfredsons heel-drop exercise programme	
Exercise	Stand on edge of a step and rise up on to your toes: lift the non-painful leg and then slowly lower your weight through the painful leg; Your heel should drop below the step Perform the exercise with both a straight and bent knee
Repetitions	3 x 15 performed with a straight knee 3 x 15 performed with bent knee
Frequency	Twice daily
Progression	Add a weighted backpack as the exercises become more comfortable

Table 2: Jonsson heel-drop exercise programme for insertional tendinopathy.

Summary of Jonsson heel-drop exercise programme	
Exercise	Rise up on to your toes; Lift the non-painful leg and then slowly lower your weight through the painful leg until your heel reaches the floor; Perform the exercise with both a straight and bent knee; Expect some pain when performing the exercises, but do not continue if the pain is disabling.
Repetitions	3 x 15 performed with a straight knee 3 x 15 performed with bent knee
Frequency	Twice daily
Progression	Add a weighted backpack as the exercises become more comfortable

Statistical analysis

The primary outcome measure was whether or not a patient was discharged after completing treatment. Since this is a binary variable Logistic Regression was used whenever we were testing the effect of the independent variables on patient

discharge. The independent (predictor) variables consisted of demographic information (such as age and gender), parameters of treatment (such as the form of the exercises used) and measurements of severity (such as the presence, duration and severity of symptoms) (Table 1). Where we wished to assess the correlation between variables we used Spearman correlation. The first stage of the analysis consisted of identifying variables showing a correlation with the outcome when tested in isolation. The second stage was to use these candidate variables to build a predictive model, with the emphasis on simplicity rather than purely on predictive power. The final stage was to perform validation on the chosen model to determine its performance in clinical practice. Validation was done by splitting the data into training and validation sets a number of times, giving estimates of the upper and lower level of performance.

RESULTS

Data summary

The final data set consists only of those patients with complete data in key demographic, baseline and outcome variables. The data collected from patients passing through the pathway consisted of 307 records. Eighty nine patients had bi-lateral symptoms. To avoid hierarchy in the data we only included one leg selected at random. There was 27 did not attends (DNA's) and 33 incomplete databases. This gave us a sample size of 158 patients.See consort diagram Figure 1.

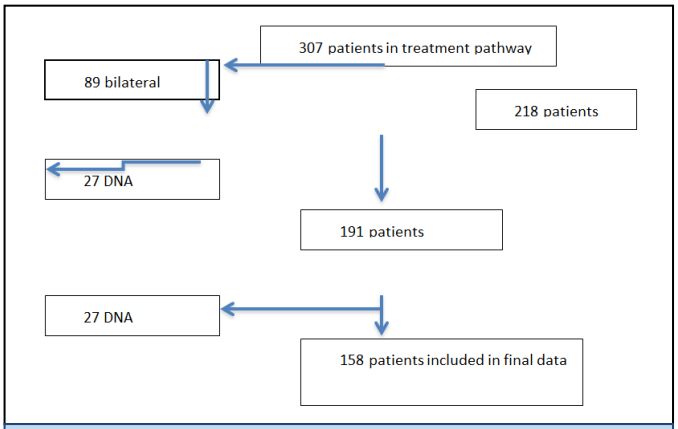

Figure 1: Consort diagram of patients included in the final data set.

Baseline data

The patients included in the analysis were split fairly evenly by gender, with 53% male (83/158) and 47% female. The patients covered a wide age range (from 20 to 83) but were mostly middle aged with mean (SD) age of 53(13). The duration of symptoms varied considerably, from 3 months to 20 years. The mean (SD) duration was 19(25) months. Pain was reported in the body (110/158, 70%), the insertion (39/158, 25%) or both (9/158, 5%) and the symptoms were split fairly evenly between right and left legs. Around a third (54/158, 34%) of patients was using insoles. Patients reported severity at baseline using both the VAS and the VISA-A scale. These were both reported on a scale of 0 to 100, although the VAS score is positively associated with pain (high values indicating high pain) while VISA-A is negatively associated with high values indicating low severity. Mean (SD) baseline scores for VAS and VISA were 50(24) and 40(18) respectively. However, for both measures the reported values spanned the entire range, from no pain to maximum pain. Unsurprisingly the two patient reported measures of severity at baseline (VAS and VISA-A) were very closely correlated. The relationship was roughly linear, with a correlation coefficient of -0.576 ($p<0.001$; Spearman).

Patient outcome

Treatment by eccentrics was successful for only a minority of patients. Only 34% of patients (54/158) were discharged during or after the treatment. Of the patients who had unsuccessful treatment (no benefit) the majority (59%, 93/158) were referred for the next clinical intervention in the treatment hierarchy. A small number (7% 11/158) were unable to complete the treatment, due to pain or complications. For patients whose treatment was successful, VAS scores decreased after 12 weeks' treatment by a mean of 30 [95% CI 24-36] points.The VISA-A increased (improved) in patients with successful treatment (discharged) and by a mean of 29 [95% CI 22, 36] points. Some of those who were unsuccessful also saw an improvement in symptoms, with 45% seeing VISA-A rise and 49% seeing VAS fall. However, the mean improvement was much lower for this group, with only a 8 [95% CI 2-14] point improvement for VAS and 3 [95% CI-1-6] points for VISA-A.

Predictor variables

As stated, the first stage is to assess whether the baseline variables possess any predictive power. There were 9 variables investigated these were; severity of symptoms (as measured by VISA-A and VAS), gender, age, duration of

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symptoms, unilateral or bilateral symptoms, side of body affected (left / right), location of pain (tendon body, insertion or both), whether insoles were issued to address foot posture abnormalities, whether the EE could be performed correctly. Each variable was examined in sequence for their association with treatment success. The results of Logistic Regression of the individual independent variables (one at a time) against success of treatment can be found in Table ?. Only four variables show any potential for predicting outcome, gender, modification or not of Eccentrics and the two severity scores. No other variable was predictive and so dropped from the model. There were significant correlations between these four identified variables. VAS and VISA-A were found to be strongly correlated (as noted earlier) but the Eccentric Exercise Quality (EEQ) was also correlated with both VAS (p=0.004; Spearman) and VISA (p=0.001; Spearman). Gender also shows significant correlation with VAS (p=0.001; Spearman). It is likely therefore that some of these variables may rely on confounding effects for their apparent significance.

Model building

The four variables identified in the previous section (Gender, Eccentric quality, VAS and VISA-A) were included to form the basis of our predictive model, based on their significance as predictors in the previous stage of bivariate screening. The Forward Selection and Backward elimination algorithms were used to determine the optimal set, both agreeing on the final model. The final model was verysimple consisting simply of the VAS pain score and the quality of EE (EEQ) (Table). The final model predicts chance of success by the pre-treatment pain score (VAS), with milder symptoms being associated with a greater chance of success. When used to predict outcomes (in the full data set) 75% of treatments are correctly predicted and a pseudo R-square value of 0.213 is observed (Cox and Snell). Furthermore, the results of the Hosmer-Lemeshow Goodness of Fit Test (p=0.840) show good agreement between the predicted and observed discharge rates when the risk level. As a theoretical model there will be over-estimation of real-world performance. The subsequent validation will address the anticipated overestimation. The predicted probability of success in relation to pre-intervention VAS score varies from 0 to over 70% and is dependent on the quality of the Eccentric Exercises (EEQ). The likelihood of success is lower for those patients who have to modify the eccentric exercises (Figure 2).

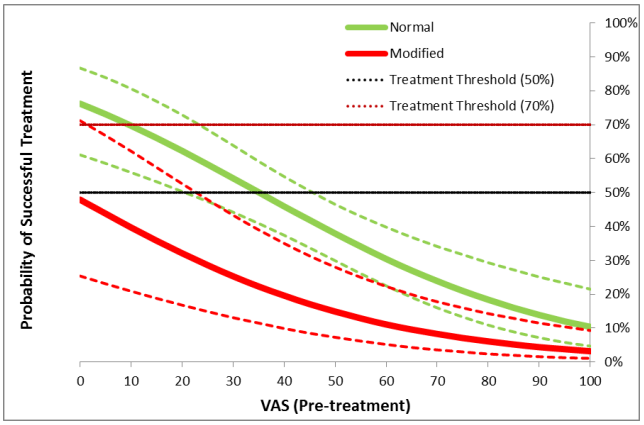

Figure 2: Predicted probability of successful treatment, with confidence intervals.

Heuristic for treatment pathway

For clinical practice we do not recommend calculating these predicted probabilities using the logistic regression model. The recommendation is to identify the VAS threshold for treatment which offers a known likelihood of successful treatment. Table outlines some sample percentage values for probability of success for different levels (thresholds) of VAS score, both for well conducted EE's and modified EE's.Note that we have determined these thresholds using the upper limit of the confidence interval for treatment success to ensure we take model uncertainty into account. This ensures that no patient should have a lower chance of successful treatment than the target success rate. To put this into some context, the plot (Figure 1) can be used to estimate the likely probability of achieving success with EE treatment (performed normally) at different levels of pre-intervention VAS pain scores.This ranges from only 10% for the very worst affected (high pain) to 75% chance of success when the pain score is very low. It is somewhat arbitrary what threshold of probability is acceptable/chosen and has to be selected with consideration of cost and inconvenience of the treatment (and local ethos). It might be that a 50% chance of success is considered worthwhile. This would give a threshold pre intervention VAS score of around 40 points.If this threshold were used as the requirement for prescribing and undergoing EE treatment (50% chance of success) any patient with a VAS score below this would be automatically progressed to the next hierarchy of

treatment without EE intervention.The examples of success probabilities for each range of VAS given in Table 3 show that the success chance for various VAS scores is much reduced when modified EEs are preformed, so much so that it is not possible to ever have 75% chance of successful EE treatment, regardless of pre intervention VAS score.

Table 3: The success chance for various VAS scores is much reduced when modified EEs are performed.

Outcome	Subgroup	Before treatment Mean (95% CI)	After treatment Mean (95% CI)	After treatment Mean (95% CI)
VAS	All patients	50.4 [46.4, 54.4]	33.6 [28.8, 38.5]	-16.9 [-12.3, -21.5]
	Discharged	39.4 [33.4, 45.4]	9.6 [5.2, 13.9]	-30.0 [-23.7, -36.1]
	Not discharged	56.0 [50.8,61.2]	48.0 [42.4, 53.5]	-8.2 [-2.1,-14.2]
VISA-A	All patients	39.5 [36.4, 42.6]	51.1 [46.6, 55.6]	+11.9 [+7.8, +16.0]
	Discharged	46.3 [41.6, 51.1]	74.2 [67.7, 80.7]	+28.9 [+21.7, +36.1]
	Not discharged	34.9 [30.9, 38.9]	37.3 [33.3, 41.2]	+2.5 [-1,+ 5.9]

Table 4: Predictive value of baseline data.

Variable	p-value	Effect Size (HR)
Gender (being Male)	0.004**	2.744 (1.373,5.485)
Age (per year of Age)	0.457	-
Duration of symptoms (months)	0.923	-
Bilateral symptoms (No/Yes)	0.525	-
Side of Body (Left/Right)	0.584	-
Location of symptoms (Body/Insertion/Both)	0.349	-
Insoles	0.773	
EEQ (Eccentric Exercise Quality)(Normal/Poor)	<0.001***	7.197 (2.410,21.488)
VAS score at baseline (per unit)	<0.001***	0.962 (0.946,0.976)
VISA-A score at baseline (per unit)	<0.001***	1.046 (1.025,1.068)

Model validation

The model was tested for robustness using a form of k-fold validation. The purpose of this model is to estimate risk level rather than predict individual outcomes and so the most appropriate way to test the model was to measure how much the predicted probabilities varied as the training set was altered. For each iteration a small subset of the data (40 records) was randomly selected and removed to form the validation set. The decision to use 40 records was to ensure the optimal balance between the two data sets. The records remaining formed the population from which training sets were sampled. For each iteration we selected a sub-sample of the training set, with replacement, and then fitted the model to obtain parameters. These parameters were then used to obtain predicted probabilities of successful treatment for the cases in the validation set. We performed 50 iterations of this process, generating a set of predicted probabilities on each occasion successwe then studied these (out of sample) probability forecasts to see how much they varied. We also examined the model parameters to see how stable they were.We found that the coefficient associated with VAS was relatively stable, while the coefficient associated with the type of eccentrics was more volatile. We ascribed this feature to a combination of the low occurrence of modified tests and the low success rate of treatment. This meant that occasionally this parameter might be very difficult to estimate. More data would be needed to obtain a robust estimate. The probabilities estimated for the individual patients generally had a standard deviation of around 8 percentage points. This meant that the individual predicted probabilities had a confidence interval of around plus or minus 17%. While in general terms this is very large, in our case we are only interested in identifying those with a very low chance of success and, with appropriate thresholds, this model might still be useful. Better parameter estimates will be obtained in future as more data is collected.

Table 5: Predictive model for treatment success.

Variable	p-value	Coefficient in Logistic Regression Model	Effect Size (HR)
VAS score at baseline (per unit)	<0.001***	-0.036	0.965 (0.949,0.981)
Type of Eccentrics (Normal/Modified)	0.003**	1.738	5.687 (1.822,17.7)
Constant	0.457	-	-

Table 6: Probability of treatment success for EE for different levels (thresholds) of pre-intervention VAS (for both high quality and low quality EEs)

Success Chance	Normal EE	Modified EE
Percentage probability	VAS Threshold	VAS Threshold
10%	ALL	85 or less
25%	95 or less	50 or less
50%	50 or less	20 or less
75%	25 or less	NONE

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DISCUSSION

The common process in rehabilitation medicine of working through a hierarchy of interventions, often from less costly and invasive to costlier and more invasive, can result in wasted resources and frustration of both clinician and patient. This is especially so if the likelihood of success from the various individual interventions is low. The trial and error method is time consuming and inefficient. A predictive model of success for individual pathway treatments, based on patient characteristics, has the capacity to enhance and accelerate the progression of treatment using evidence based methods [7,8,10,11,13]. After identifying the frequency of success, we developed a model predicting the post treatment outcome in patients with an Achilles tendinopathy completing a 12 weeks EE program, using pre-treatment demographic data and outcome measures.It was observed that 2 of the 9 variables assessed pre-treatment VAS scores and the quality of EE's performed modifications of the exercise program could predict EE outcome in patients with Achilles tendinopathy. In this study only 34% (54/158) of patients undertaking eccentric exercises were discharged having obtained sufficient benefit (treatment success). This shows that intervention is only effective in a relatively small number of patients and is contrary to the sizeable body of literature of eccentric exercises, including guidelines from the American Physical Therapy Association (APTA) 2018 which demonstrated grade A evidence for them [25]. It is wasteful and inefficient to prescribe such an intervention to all patients suffering from Achilles Tendinopathy. In clinical practice the model from this study can be used for shared decision making.Patients with a VAS score of 25 or less have a 75% chance that the EE program will be successful and will result in the patient being discharged from care with a satisfactory outcome. In contrast if the pre-treatment VAS score for a patient is between 100-95 there is only a 10 % chance of success with the EE program and the patient is likely to get little benefit from the intervention and there is an argument the patient should be referred on to another treatment without attempting EE. VAS scores are easy to obtain and can be employed more gainfully in the decision making process. To our knowledge, this is the first prognostic model that has been developed and validated in a prospective study for the use with Achilles tendinopathy patients. The advantages in this approach to providing evidence based decision making is that the study is embedded within real world conditions, with routine data collection, and does not require complex and expensive trial methodology.The external validity is therefore very high. It is not possible to compare and contrast these results to previous studies in terms of determining if an EE program is likely to not work since no other study has investigated this. However, the Minimum Clinically Important Change (MCIC) has been set for the VISA-A is questioned. Tumilty et al. suggested success as an increase of 20 points [26], while other studies used an increase of 12 points as MCIC for VISA-A scores [27,28]. In this study patients where only happy to be discharged with a mean change of 28.9 points on the VISA-A, suggesting that the MCIC maybe should be seta lot higher than has been previously suggested. There are limitations and considerations to the study. It was not possible to model patient trajectories without EE and therefore a natural history control group is absent. The study cannot confirm that EEs alone are responsible for change (improvement) in health status. However, this is difficult to obtain from an ethical perspective for established treatments. The lack of long-term data (ie we only looked to 12 weeks) is also a shortcoming. Some patients will only have temporary improvement and long-term data are needed. Moreover, we only evaluated a binary outcome (improvement/no improvement) and a metric accounting for more granular outcome may be helpful. It is also possible other, non-collected variables may have had influence on the predictive model, such as BMI. Also the data collection was not fully blinded; however, the clinicians collecting the data were blinded to which of the risk factors and outcomes were being used in the final analysis. Another limitation is the EE program was used in isolation, often management regimes up the hierarchy are performed in conjunction with EE e.g. ESWT and EE. This model cannot act as a baseline assessment for these combined treatment regimes. Another limitation was the Achilles tendinopathy was clinically and not radiologically diagnosed.In routine clinical practise Achilles tendinopathy patients are not usually scanned in the initial stages of treatment.A final comment is that it may be considered no surprise and self-evident that patients with poorest pain scores and an inability to perform the remedial exercises will not do well in terms of benefit. However, to ascribe values of probability to the likelihood of benefit is

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extremely helpful in designing policy changes and clinical pathway management.Without quantitative data the "trial and error" process will endure. The overall results of this study suggest that this final validation model could be used safely and effectively in a clinical setting for assessing in the management of Achilles tendinopathy patients. It is inevitable, however, that the final decision on patient management must be individualised and many factors that cannot be translated into a statistical model must be considered. The overall purpose of the prognostic model is simply to guide clinical decision-making, not replace it.

Implications for clinical practice: This predictive model can be used for shared decision making with patients. By the patient simply indicating their VAS score, the clinician can advise the patient of their likelihood of success with this treatment. From our experience in clinical practice this decision is very much a personal decision to the patient rather than a decision which should be made at a management / strategic health board level. We have found that some patients are keen to trial the EE program even if there is a less than 10 % rate of success since theynot wantto have more invasion treatments.

Implication for future research: Our next priority is to examine the predictive results of the other treatments in our hierarchical model, namely ESWT, Dry needling and surgery. Further studies can also look at the results of EE in combination with other treatments, since EE are often used in combination with our interventions e.g. ESWT

CONCLUSION

A new predictive model can assist the clinicianand patients in the shared decision making for the use of EE for anAchilles tendinopathy. Patients with a VAS score of 25 or less have a 75 % chance that the EE program will be and result in the patient being discharged from care with a satisfactory outcome.

ACKNOWLEDGEMENT

We would like to thank Alison Hill and Tanya Francis specialist Foot and Ankle physiotherapists who instructed the EE to the patients and helped collect the data.

Conflict of interest

Nil

Ethical approval

The local ethics committee confirmed that ethical permission was not required for this study. It is classed as a service audit/evaluation and uses pre-existing management level, anonymised data.

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