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An exploration of clinical reasoning and practices used by physiotherapists in the rehabilitation of horses following interspinous ligament desmotomy surgery

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Keywords: clinical reasoning, veterinary physiotherapy, animal physiotherapy, interspinous ligament desmotomy

## ABSTRACT

### Introduction

Clinical reasoning has not been studied in veterinary physiotherapy and so the methods used and factors involved are unknown. Similarly, the practices of veterinary physiotherapists within a certain rehabilitation programme have not been documented. The aim of this study was to explore the clinical reasoning and practices of veterinary physiotherapists during rehabilitation of horses following interspinous ligament desmotomy surgery.

### Methodology

A qualitative approach was taken and six members of the Association of Chartered Physiotherapists in Animal Therapy were interviewed using a semi-structured approach. The data were transcribed and analysed using Thematic Analysis.

### Results

Five themes were identified as relevant to the participants clinical reasoning. These related to structure of the assessment, modalities and reasoning of treatment, involvement of owner and veterinarian and the impact of comorbidities. The data highlight several different factors that influence clinical reasoning and decision making throughout the rehabilitation. An insight into practices involved is also documented.

### Conclusion

The process of clinical reasoning and decision making described appears complex. The input of both owner and veterinarian are evidently important and require the physiotherapists consideration. Decisions regarding assessment and treatment are influenced by many factors. A mixture of clinical experience and research evidence were used as support.

Keywords: clinical reasoning, veterinary physiotherapy, animal physiotherapy, interspinous ligament desmotomy

## INTRODUCTION

Clinical reasoning (CR) is a core element of the profession and practice of physiotherapy (Chartered Society of Physiotherapy, 2016) and defined as “the sum of thinking and decision-making (DM) processes associated with clinical practice” (Higgs and Jones, 2008). The complex concept is influenced by many different factors and varies depending on patient issues and circumstances (Smith, Higgs and Ellis, 2007). It touches all areas of practice, enabling the physiotherapist to make the best decisions and take appropriate actions (Higgs and Jones, 2008).

CR has been explored in areas of physiotherapy such as cardiorespiratory (Smith, Higgs and Ellis, 2007; Smith, Higgs and Ellis, 2008), acute care (Holdar, Wallin, Heiwe, 2013), musculoskeletal (Cruz, Moore and Cross, 2012), shoulder pain (May, Greasley, Reeve and Withers, 2008; May, Withers, Reeve and Greasley, 2010) and back pain (Karvonen, Paatelma, Laitinen-Väänänen and Piirainen, 2017) identifying the use of various CR models. Physiotherapist experience and context appear to have a role in which models are used with expert physiotherapists using a mixture of models such as pattern recognition, hypothetico-deductive reasoning and narrative reasoning in the assessment and treatment of patients with shoulder pathologies. In comparison, novice physiotherapists also treating patients with shoulder pathologies used limited hypothetico-deductive reasoning and no pattern recognition (May, Withers, Reeve and Greasley, 2010). More recently, the demands for greater efficiency and improved outcomes in practice, puts more focus on CR of the physiotherapist (Jones and Rivett, 2019). Therefore, the physiotherapist must use CR and DM to ensure they are appropriately using the best available evidence in the management of the individual patient.

While CR and DM have been investigated in relation to human physiotherapy, they have not been explored in the specialty of veterinary physiotherapy. Therefore, it is not known if similar methods are used or if they differ or their effect on outcome. Also, as many areas of veterinary physiotherapy have not yet been examined by studies, there is a need for good CR and DM to ensure that practice is effective and efficient for the individual animal patient.

Overriding dorsal spinous processes is recognised as one cause of thoracolumbar pain and has been reported to be the most common bone pathology of the thoracolumbar vertebrae (Clayton and Stubbs, 2016). The prevalence among horses with back pain is reported at 68% (Turner, 2011). Interspinous Ligament Desmotomy Surgery (ISLD), as described by Coomer, McKane, Smith and Vandeweerd (2012), is one surgical treatment option. This involves cutting the interspinous ligaments between the affected processes. Following surgery a rehabilitation programme is often commenced. The aims of this programme are to resolve spasm of epaxial muscles, increase activity of muscles such as multifidus which stabilise the spine and to improve both movement of the spine and core strength (Coomer, McKane, Smith and Vandeweerd, 2012). This is carried out alongside a progressive exercise plan that follows a period of restricted exercise. Anecdotally, physiotherapists are frequently involved in the post surgery rehabilitation, however, little is known of their practice in this rehabilitation.

The aim of the study was to explore the CR and practices of physiotherapists in the rehabilitation of horses following ISLD.

## METHODS

### Study design

A qualitative approach was taken and a semistructured recorded interview used to collect data to provide a framework to the interview and also enabling divergence to explore responses or ideas in more detail (Rosenthal, 2016). Ethical approval was gained in accordance with Hartpury University Ethics Panel guidelines.

### Sampling and recruitment

Purposive sampling was used to recruit participants by sending an email to all members of the Association of Chartered Physiotherapists in Animal Therapy (ACPAT), a Professional Network within the Chartered Society of Physiotherapy, inviting them to take part in the study as well as use of posting on social media within the professional network group.

### Participants

Participants must have been practicing as ACPAT Veterinary Physiotherapists for at least two-years and were also required to be treating horses following ISLD surgery this year. Each participant was given an information leaflet and signed a consent form after agreeing to take part.

### Data collection

An interview guide (see supplementary Information) was created using ideas from similar human studies (Holdar, Wallin and Heiwe, 2013; Masley et al, 2011) and adapted to make it relevant to this topic. Consideration was also given to studies which briefly discussed rehabilitation following the surgery from the veterinarian's perspective (Coomer, McKane, Smith and Vandeweerd, 2012). The guide contained an introduction to describe the interview and ensure participants understood the process. The questions were used to provide some structure to the interview but alterations were made depending on responses and the flow of the interview. Prompts were used where needed to encourage more detail as suggested by DiCicco-Bloom and Crabtree (2006).

In a pilot interview, a veterinary physiotherapist who met the inclusion criteria was interviewed using exactly the same format as the interviews for the study. Following the interview, minor alterations were made to the questions to encourage more detailed answers to some questions. The participant was also asked if they felt any changes were necessary from their perspective.

The interviews took place mostly over the phone recorded on an iPhone (iPhone SE, China) using the voice memo app and a back up recording made using the Just Press Record app (Open Planet Software, Version 3.2.4) on an iPad (iPad Pro, China) and took approximately 30 minutes each.

The collected data were used anonymously, therefore, the names used here are pseudonyms.

### Analysis

Following the interviews, the data were transcribed by the researcher. Transcriptions were checked for accuracy against the recording.

Thematic analysis was used to analyse the data collected. It was guided by the six-phase process as suggested by Braun and Clarke (2006). It should be noted that despite the linear structure, the analysis took an iterative and reflexive approach which is a common feature of thematic analysis (Petty, Thomson and Stew, 2012). Thematic analysis was chosen as it provides some structure to the process while retaining flexibility to enable adjustments to suit the particular study (Clarke and Braun, 2014). Relevantly, Braun and Clarke (2006) recommend this method for topics where views have not been previously researched as it provides a rich description of the major relevant themes. Following transcription and further familiarisation with data, relevant text was highlighted and codes generated and assigned. There were two sweeps of coding where codes were collapsed, renamed and abandoned as appropriate. Codes were grouped together where there were connections and sub themes and themes generated.

The codes were created from the data i.e. open coding, not pre-determined to not encourage participants to answer in a particular way. However, a deductive approach was taken to analysis as it was somewhat guided by the questions set and the focus of the research (Braun and Clarke, 2006). A mix of descriptive and analytic questions were used to identify codes (Charmaz, 2006).

From these codes, themes were identified. A set figure for prevalence was not set when identifying themes as a theme does not have to be prevalent but should be consistent or identify something important to the study (Braun and Clarke, 2006).

Dependability throughout the study was maintained by keeping a paper trail of all stages, drafts and notes from transcription through coding to themes.

## RESULTS

Following recruitment, six participants who met the criteria agreed to take part. They ranged in time since qualification from six years to 28 years. The number of horses treated post-surgery in the last year ranged from 2-20.

Several themes and sub-themes were identified as relevant to the participants CR in rehabilitation following ISLD (Table 1). The five themes identified were:

- Assessment is framework guided and influenced by various factors
- Various treatment modalities are used and clinically reasoned
- Owners have an integral role in rehabilitation
- Veterinarian involvement and influence throughout
- Comorbidities can affect progress and outcome

Table 1: Identified Themes and Subthemes

THEME	SUBTHEME
<b>ASSESSMENT IS FRAMEWORK GUIDED AND INFLUENCED BY VARIOUS FACTORS</b>	Initial assessment timing varies
	Assessment is influenced by factors relating to vet protocol and surgery
	Initial assessments are standard in structure but individualised
	Initial assessment findings are usually similar
	Comorbidities can feature during assessment
	Outcome measures are used throughout
	Measures are used to assess immediate effect of treatment on the horse
	Objective measures are used when available
	Subjective measures are used
Visit frequency varies for different reasons	
<b>VARIOUS TREATMENT MODALITIES ARE USED AND CLINICALLY REASONED</b>	Treatment modalities used can vary
	Various treatment modalities are reasoned and used
	Some reasoning is supported by clinical experience
	Some reasoning is supported by research
	Treatment decisions are influenced by various factors
	Progression of treatment is guided by findings and timing
<b>OWNERS HAVE AN INTEGRAL ROLE IN REHABILITATION</b>	Owner input is important and needed for successful outcome
	Owner input covers many areas
	Owner ability and compliance are influencing factors
	Owner education and understanding are important
<b>VETERINARIAN INVOLVEMENT AND INFLUENCE THROUGHOUT</b>	Veterinarian protocol influences many areas
	Veterinarian communication is needed at times
	Other veterinary related issues are a common problem
<b>COMORBIDITIES CAN AFFECT PROGRESS AND OUTCOME</b>	Comorbidities impact upon many areas
	Comorbidities impact upon outcome

1. Assessment is framework guided and influenced by various factors

Timing of the initial assessment following surgery varied between participants from 3-4 days post-surgery to commonly, 10-14 days post-surgery.

*Well, on the surgical discharge report they want physio a week post-op so I wouldn't see anything sooner than a week post-op. So, no less than a week but more often than not it's two weeks before I get to see the cases.*

Lisa

The assessments generally followed a similar format and included history taking, wound check, static observation; palpation, joint range of movement and gait assessment.

The assessment is influenced by the acuteness of the wounds and presence of staples and dressings, pain levels, restriction on movement.

*I might see them walk up and down and just do a turn at the end and walk back and do another turn and then do some tight circles to the left and to the right but I wouldn't do anything more than that in the first assessment. And then next assessment, a week or two weeks later, I might see them trot up and down, depends on their pain levels and when I get to see them.*

Lisa

Reported common findings from assessments varied between participants. Following observation and palpation, some reported poor abdominal tone, lordotic posture and epaxial muscle spasm and atrophy. Pain levels, measured by palpation, behavior observation and owner feedback, varied dependent on time since surgery and the presence of other pathologies.

*It varies depending on the horses pain levels post-surgery so some horses you will assess them and on palpation they are still quite painful and there is still a lot of active inflammation and the wound sites, particularly if you go there quiet soon.*

Lisa

One physiotherapist took a different approach to reporting of findings, focusing on movement patterns and muscle imbalance.

Most participants reported how assessment findings will influence their treatment decisions and choices.

*I might vary between myofascial techniques, trigger point release, massage, depending on how the horse is sensitive wise, whether they are feeling quite comfortable, I will adapt that to the horse.*

Ann

The participants used outcome measures during assessments to monitor the effect of treatments, guide their decisions regarding progression and for measuring outcomes. Measures reported as being objective included flexi-curve to measure epaxial bulk, photography, palpation scores and joint range of movement.

*I'm using my palpation skills on reassessment, so I document when I first assess the horse, my findings, areas where the muscle spasm are anatomically, and then reassess them a week or 2 weeks later and see if there's been a change in how they palpate*

Lisa

Subjective measures included measuring the horses' behavior and pain levels. This often came from owner feedback which was also used to measure the success of the rehabilitation.

*I think their view of their horse is very valuable, they know that horse better than anyone so if they are feeling that the demeanor of the horse has changed or they have got the horse back, as much as that's not very scientific, that does mean a lot.*

Dee

Visit frequency varied due to time since surgery, assessment findings, treatment carryover, finances and owner input.

*Once a week allows me to get some carry over especially with soft tissue work and it also allows me to assess the horse and make sure there is nothing going wrong and nip it in the bud if it is going wrong and it just gives you that face to face with the owner as well each week, checking in. But sometimes that is not possible either finances or insurance problems.*

Dee

## 2. Various treatment modalities are used and clinically reasoned

Various modalities were reported as being used by the participants (see supplementary information). There were similarities with Dynamic Mobilisation Exercises (DME)/carrot stretches/baited stretches, soft tissue techniques and long-reining being the most commonly mentioned.

The treatments chosen were supported by clinical experience and/or research evidence. Five of the six participants give owners DME to carry out regularly. They all gave similar reasoning for carrying out these exercises.

*And then when you are doing the DME / carrot stretches you can sometimes see the abdominals kick in or not kicking in and then the back moving as a result but I think it gives you quiet a good feedback that you can actually see the effects and how that's going to affect the spine and the tissue around the spine. But yeah, we are quite lucky that we have got some nice research to support those exercises. In these cases, its perfect for these guys, yes, we want to build up the spinal stabilizers and yes, we want to build up the abdominals.*

Ann

Regarding the use of exercises the participants mentioned exercise selection preference. Four physiotherapists preferred exercising the horse in straight lines (long-reining) over circles (lunging) and two preferred a mixture of both.

*I think if I had a choice and I could do whatever I wanted, I think that long-reining is probably going to be the best option to start with, I think it's going to be an easier way for the horse to start to develop muscle tone and muscle strength through the body without overloading various joints.*

Ann

Other factors considered in the decisions regarding treatment are compliance, safety and appropriate timing. Treatment was influenced by wounds, stitches and pain levels, presence of other pathologies, recent exercise history and owner ability. Treatments were progressed guided by findings from reassessment, time since surgery and the absence of any problems.

*Progression, I suppose hopefully with time you will see improvement in your subjective/objective markers.*

Sally

## 3. Owners have an integral role in rehabilitation

The importance of owner input was strongly highlighted by all participants as they can provide the necessary daily or regular input which is not possible for the physiotherapist.



*So, between my visits, I want them to maintain what I've achieved and to consolidate what I've achieved within my visit*

Jess

All six participants mentioned that they would give the owner an exercise programme to carry out with the input dependent on their ability and compliance, with exercise such as long-reining and use of neuromuscular electrical stimulation only being given if the owners were capable and motivated. The need for support and monitoring of owners is highlighted.

Owner education regarding the rehabilitation process and their input, was mentioned by all participants, particularly being necessary for a successful outcome.

Many mentioned the need to ensure that owners understood the long-term nature of rehabilitation and that the surgery alone will not give a good outcome.

*They think, oh my horse has had surgery, it's all fixed.*

Ann

Participants report the use of owner feedback on the horse to measure outcomes and guide treatment decisions.

*Asking them if the horse is comfortable putting his head down or it seems to be rolling in the stable or is it happy getting up and down, is it happy having a rug put on or taken off, things like that. So, I'm looking for pain markers from the owners.*

Lisa

#### 4. Veterinarian involvement and influence throughout

Veterinarian involvement often began with a recommendation for referral to a physiotherapist either before or after surgery.

*Some (clients) are new following surgery, they have been recommended, especially the ones from the referral centers that have been recommended to get an ACPAT physio.*

Sally

The veterinarians' post-surgery protocol dictated timing of initial assessment, exercise restriction, use of lunging aids and timing of return to ridden exercise. Communication was needed at times with the veterinarian regarding pain relief, concerns arising or physiotherapist desire for changes to exercise programme.

*We get a little tricky then because the vets have recommended one thing and we have to be a little bit careful that we don't want to advise against the vet's advice.*

Ann

Veterinarian involvement was necessary in the diagnosis and management of comorbidities.

*if the horse has underlying spinal pathology, they in my experience, can do well but as long as the physiotherapist and the vet work closely together*

Lisa

#### 5. Comorbidities can affect progress and outcome

The impact of other pathologies, diagnosed and undiagnosed, was highlighted in many areas as they impact assessment findings, exercise choice and the owner.

*But say if there are particular cases, they have kissing spines but also sacroiliac problems or hock arthritis, then actually I think doing lots of lunging might make those problems worse which might then affect how the back is used.*

*Ann*

They can affect progression and outcome, with five participants highlighting the need for diagnosis and management of other pathologies, as being necessary for a successful outcome.

*Also, I think one of the key ones is a, whether they have got the diagnosis right in the first place and b, any other pathology going on in the horse, bilateral hindlimb stuff going on.*

*Sally*

## DISCUSSION

The results of this study show that throughout this rehabilitation programme, physiotherapists are constantly using their CR and DM skills to carry out assessments and treatments they feel are appropriate for each individual horse. Five themes emerged from the data and were considered key features of CR in the rehabilitation of horses following ISLD.

### 1. Assessment is framework guided and influenced by various factors

It was clear that the assessment generally followed a framework similar to that described by Goff (2016) and anecdotally used by many physiotherapists. However, during the assessments, the participants CR and DM were clearly influenced by factors such as wounds, pain levels and movement restrictions. Influencing factors have previously been identified by Smith, Higgs and Ellis (2007) in relation to cardiorespiratory physiotherapy. The presence of such factors is not surprising considering the complex nature of CR as identified by the literature review. Their decisions on content and means of assessment were made with regard to these resulting in individualised assessments.

A lack of objective measures to quantify findings was highlighted by Tabor and Williams (2018) and is echoed by participants as a difficulty in assessment which plausibly adds to the complexity of CR. This may prevent the physiotherapist from accurately knowing the effect of their treatment. The findings from the assessment clearly informed treatment choices. It would appear during this process that the participants were using the information from the assessment to create a hypothesis regarding the problems present. An appropriate treatment was then chosen. The hypothesis was either confirmed or negated following reassessment and the gathering of further information. Reassessment was used to identify the appropriateness of progression or to highlight any problems.

This process appears to be an example of hypothetico-deductive reasoning (Edwards et al, 2004) and is not previously described in veterinary physiotherapy. Some state that this is a feature of novice physiotherapists (May, Withers, Reeve and Greasley, 2010), however, when used in an iterative fashion alongside narrative reasoning, it forms a dialectic model of reasoning which is a feature of experienced physiotherapists (Edwards et al. 2004).

### 2. Various treatment modalities are used and clinically reasoned

The treatment modalities chosen by participants were supported by research evidence and/or clinical experience. The commonly used DME were stated to be chosen because of the available evidence of their effectiveness (de Oliveira et al, 2015; Stubbs, Kaiser and Hauptman, 2011; Tabor, 2015) to increase the cross-sectional area of multifidus.

Other modalities had less stated evidence to support them. This is possibly due to a paucity of available evidence, specifically equine. Therefore, it is hypothesised that the participants were drawing from both equine and human clinical experience and where applicable, human evidence. For example, there is limited evidence to support the use of the equine manual therapy technique called reflex inhibition (Wakeling, Barnett, Price and Nankervis, 2006) in pain free horses. When its use was mentioned by participants, they stated they would not use it in early stages as it would be too severe/painful. This example shows the difficulties faced by physiotherapists when trying to CR and DM in the absence of supporting evidence and how they therefore use their experience alongside CR skills to decide when and which modalities are appropriate.

There was a strong preference for the use of long-reining over lunging among participants. While two participants used lunging in their rehabilitation programmes, they did it in combination with long-reining, with one stating it was to avoid effects of excessive lunging.

The reasoning given for the preference was the possibility of other problems being caused, presence of other pathologies and limitations in regard to using hills. The benefits to long-reining were stated as being easier for the horse when returning to exercise and ability to be in straight lines rather than continually on a circle. These ideas are supported by Nankervis, Launder and Murray (2017), who state that straight line exercise is easier for the horse in rehabilitation as when circling the horse needs greater stability, control and coordination of movement. However, this theory remains to be proven in research.

Factors considered in the choice included owner ability and horse safety. Alternatives such as leading the horse out on foot or from another horse were mentioned. Again, these highlight the high number of decisions that need to be made covering many areas.

Related to lunging, was participants not wanting to use a training aid to influence the horse's posture, called the Pessoa training aid (PTA). The same participants who chose the combination of lunging and long-reining, were also more favorable to the use of the PTA. However, the reasoning for its use was mixed. One participant used it to encourage abdominal control, whereas another didn't like the fact that it wouldn't encourage abdominal activation. The study by Walker, Dyson and Murray (2013) was mentioned in support of its use. Another participant stated that while research showed it helped to increase lumbar flexion, there was no evidence for its use in thoracic flexion. While the study does suggest that through its mechanism of action, the PTA could activate the abdominal muscles, this was not directly measured. Therefore, the individual physiotherapist needs to draw their own conclusions regarding its use for abdominal muscle activation. This difference in opinion suggests that there may be a lack of awareness of research findings or differences in interpretation. This again suggests the need for further research that is clear in its findings and accessible to physiotherapists to assist them in CR and DM.

The data from this study identify the many factors considered during CR of treatments in rehabilitation following ISLD surgery. The evidence used to support this comes from

a mixture of clinical experience and research. The lack of available research potentially impacts upon decisions as the most effective treatments are unknown. Despite this, attempts are made to use the available evidence alongside clinical experience. The variety of treatments used by participants and the large number of influencing factors in choice of treatment, suggest that such rehabilitation programmes need to be considered on an individual basis and may not be suitable for a stringent pre-determined protocol approach.

### 3. Owners have an integral role in rehabilitation

The results show the important and necessary role of the owner in the rehabilitation programme. It is evident that the CR and DM process that the physiotherapist goes through within this programme is strongly influenced by factors relating to the owner.

The stated necessary owner input for a successful outcome emphasises the need for the physiotherapist to understand the owner's motivation and ability to participate in the rehabilitation. This was evident in participants having discussions with owners regarding their involvement. They also took a detailed history and established goals with the owner. This links to discussion by Holdar, Wallin and Heiwe (2013), where physiotherapists showed evidence of narrative reasoning by trying to understand and collaborate with patients during the assessment and treatment. Narrative reasoning is focused on learning about the patients experience and circumstances and the value of this (Edwards and Richardson, 2008). It appears that physiotherapists in this study are using narrative reasoning as a model of CR.

As well as the owner providing a large input, they also provided valuable feedback which was used to guide reasoning and decisions. However, the ability of the owner to notice change (Scantlebury et al, 2014), assess wellbeing (Ireland et al, 2012) or detect movement asymmetry (Rhodin, Egenvall, Andersen and Pfau, 2017) is debated. Therefore, although the owner is best placed to provide valuable feedback due to familiarity with the horse, the objectivity and accuracy of this could be questioned. The accuracy of owner feedback needs to be examined further as it is relied on heavily in ISLD rehabilitation.

Closely related to their input, was the need for owner education. Owner education was mentioned both implicitly and explicitly by all participants and covered a range of areas. Owners were made aware of the importance of their role and need for their input which was considered essential for a successful outcome. At the beginning of the rehabilitation programme, owners were advised on setting realistic outcome goals. The rehabilitation process and the long-term nature of it was reportedly made clear and reasoned to the owners.

One participant mentioned the use of "education to empower" the owner and how she felt strongly that owners were given a written plan outlining the rehabilitation programme and that helps with exercise compliance. They were also given relevant information leaflets. Compliance with the rehabilitation in general appears to be mixed due to the participants regularly highlighting the need to ensure owners awareness of their need to comply throughout. Owner compliance has been linked with outcomes in different programs (Gill, Pratt-Phillips, Mansmann and Siciliano, 2016; Taylor et al, 2014). They suggest that giving owners educational material and means of recording weight could have increased compliance. However, in relation to CR in this rehabilitation programme, it is apparent that the need for owner education is strong

and needs consideration by the physiotherapist as it impacts upon their treatment choices. The most appropriate means of doing this may depend on individual owners and circumstances. The follow-on effect of this on compliance is also likely to be owner dependent but important to consider. Linking to narrative reasoning, Edwards and Richardson (2008), suggest that this form of collaboration enables setting of patient-centered goals. These consider the patient, their views and circumstances resulting in greater compliance as the goals are more relevant to and achievable by the patient.

Owner feedback was also used to measure the success of outcome. Owner satisfaction in terms of return to previous level of work or to level that was the established goal was used by all participants to measure the success of the rehabilitation. Owner satisfaction as an outcome measure is also used following colic surgery (Christopherson et al, 2014; Davis et al, 2013). However, Davis et al (2013), highlight the need for owner education regarding potential complications and comorbidities such as lameness that may impact upon expected outcome. This is relevant also in this rehabilitation and is identified by participants when they state the need for the owner to set realistic goals and the importance of education regarding comorbidities that may impact on outcome.

Physiotherapists should also consider when using feedback as a measure of success at the end of rehabilitation, that owner satisfaction of the outcome likely incorporates contributions from the surgery, veterinarian and any others involved and is not solely a measure of physiotherapy success.

Human studies (Holdar, Wallin and Heiwe, 2013; Smith, Higgs and Ellis 2007; Smith, Higgs and Ellis, 2008) have identified the importance that interaction with the patient has on CR and DM. It appears that similar is true in this study, even though there is an involvement of a third party in the owner. From data collected, the need for physiotherapists to consider many owner related aspects in CR during this rehabilitation is evident.

#### 4. Veterinarian involvement and influence throughout

This theme was identified as the veterinarians input impacts on many areas and therefore, must frequently be considered in CR and DM.

The timing of the initial assessment varied usually due to the veterinarians' post-operative protocol. This influenced the assessment as those carried out closer to the surgery and before stitches were removed, had to consider the wound, pain and veterinarian instructed movement restrictions.

Some participants highlighted the need for communication with the veterinarian. One reason given was to discuss the possibility of long-reining the horse rather than lunging in a PTA. As discussed in the treatment section, there was a general preference for the use of long-reining. However, some veterinarian protocols advise lunging in a PTA. Participants were evidently using CR skills to choose the most appropriate means of exercise for the individual horse. However, there was also a desire not to disagree with the veterinarian's instructions. Under the Veterinary Act (1966), consent must be given by the veterinarian for a physiotherapist to treat a horse. Therefore, it is necessary to retain a good working relationship with the veterinarian and this was considered by the participants in this study. However, it also adds another factor to consider in reasoning and DM.

Veterinarian input was also evident when further post-operative pain relief was needed and problems arose such as lack of progression or lameness. This again shows the need for communication with the veterinarian.

In this study, it appears that participants made decisions regarding what they felt to be the best treatment option but were at times constrained by the veterinarian in attempting to carry them out. However, it must be remembered that veterinary physiotherapists work under the permission of the veterinarian and the surgeon will also be aiming for the best post-surgery rehabilitation.

#### 5. Comorbidities can affect progress and outcome

This theme was chosen as it was strongly highlighted by five of the six participants as being very relevant. Its importance is further highlighted with most participants identifying the need for diagnosis and management of comorbidities to have a successful outcome to the rehabilitation. Comorbidities mentioned included facet joint, sacroiliac, cervical spine or hind limb pathology.

Its importance is again highlighted by its evident impact upon many areas of the rehabilitation. For example, participants reported screening for signs of comorbidities during assessments with high post-operative pain levels being suggested as a sign of other existing spinal pathology.

This identification of the impact of comorbidities is supported by evidence from Coomer (2014) which states that of 142 horses who underwent ISLD, 35% had a pre-surgery diagnosis of lameness and 33% of the remaining horses had a lameness diagnosed, at a median of 183 days, post-surgery. The author highlights that lameness is the most common cause of failure to return to long term normal use following the surgery.

The finding by Greve, Dyson and Pfau (2017), that resolution of hindlimb lameness resulted in improved symmetry and movement of the thoracolumbar region, also supports the benefit of pre-surgery lameness treatment. It also confirms the effect that lameness has on back pain and therefore why lameness will have a negative effect on rehabilitation outcome. This supports the physiotherapists consideration of comorbidities during reasoning in their assessments and treatments.

This finding suggests that owner education and goal setting should address the possibility of this problem arising. A recent study (Davies and James, 2018), has identified the presence of psychological distress in amateur horse owners following injury to their horses. Therefore, it is appropriate that some participants stated they feel part of their role is owner support and guidance and supports the need for owner education on the subject.

This evidence shows the potential impact of comorbidities and associated factors on the CR process of the physiotherapist throughout the rehabilitation and supports the identified need for their recognition and management to achieve a successful outcome. Increased owner and veterinarian awareness of this issue in the pre-operative stages could be beneficial to avoid issues arising post-operatively.

#### Limitations of study

Purposive sampling was used which some argue increases bias and limits generalisability of the study. However, qualitative studies are contextual and do not

seek to be generalisable. Transferability is more relevant and it is up to the reader to assess the appropriateness of transferability to their setting (Kuper, Lingard and Levinson, 2008). Therefore, this study does not attempt to make inferences to other rehabilitation programmes.

Sample size calculation is another contentious issue in qualitative studies (Vasileiou, Barnett, Thorpe and Young, 2018). This study sought to recruit as many participants as possible as it is an exploratory study. However, it was drawing from a relatively small population of ACPAT members. Of these, many do not treat horses and less again are involved in rehabilitation following ISLD. While not as many as hoped were recruited, only small amounts of new information and no new themes were identified in the last two interviews and the themes identified throughout were consistent. This suggests that saturation was reached which many authors define as the end point for data collection. Also, depth and quality of data were the focus of the study rather than quantity. While Braun and Clarke (2019) recognise that the concept of saturation appears in many qualitative study checklists, they feel it is generally not a useful tool within their view of thematic analysis. They prefer a focus on adequacy of data rather than quantity as it is possible to always get new information from data. This also supports the possibility of small samples being sufficient when gathering data. If a measure must be used, they suggest the use of information power (Malterud, Siersma and Guassora, 2016). They suggest the size of the sample to provide sufficient information power is dependent on factors such as the aim of study, sample specificity and analysis strategy. They also echo the belief that smaller sample sizes may be sufficient to provide enough information.

Although, this study set out to get an overview of the topic as an exploratory study, it may have been beneficial to concentrate on one area such as assessment or treatment. This would have enabled further depth of questioning and therefore, understanding. Owing to the complex nature of CR, it is possible that the methods used did not result in an accurate representation of the topic. The use of a second method, such as observation may have given different results. Similarly, the study could have benefited from a second researcher as these findings are only one persons interpretations of the interviews.

#### Future research

Taking the limitations mentioned into consideration, future studies could further explore CR and DM of more specific areas focusing on topics such as particular treatment modalities or methods of exercise used within this post-operative ISLD rehabilitation programme. Exploration of CR in the use of specific treatments within rehabilitation programmes for conservative management of ORDSP and other musculoskeletal conditions such as sacroiliac joint region pain (Dyson and Murray, 2003) would also be useful. Conversely, as it was found useful in this study, future studies could explore the practices of physiotherapists in these rehabilitation programmes as well as the CR and DM, certainly as a starting point. Following on from that, separating the two areas would enable more in-depth evaluation. The use of other methods such as observation may also be beneficial to support interviews.

As highlighted in this study there is a paucity of evidence investigating the use of different treatment modalities, exercise and training aids in horses generally and specifically following ISLD surgery. Therefore, to assist physiotherapists in their CR and DM, further research is needed into the physical and biomechanical effect of different training aids such as the PTA and exercise such as lunging. Having more

information on the effects and use of these would enable the physiotherapist to assess the suitability of their use for the individual horse when CR and DM.

As this is the first study of its kind in this area, it would be interesting to explore different settings, therapist training and experience level to identify different models of CR used, similar to in human studies.

Any future studies would contribute to a body of work that develops an understanding of CR within veterinary physiotherapy and demonstrates the complexity and reasoning skills involved. This will identify areas that need further investigation to support evidence based practice and help to inform CR and DM. The knowledge gained can be used in education and clinical practice to improve the quality of CR and DM, thus leading to improved outcomes.

## CONCLUSION

This study provides an overview of the CR used by physiotherapists in rehabilitation programmes following ISLD surgery on horses. The process of CR and DM described in this study appears to be complex, involve many different factors and requires flexibility of process and thoughts and the involvement of others.

The themes identified show that reasoning is being used at all stages throughout the rehabilitation and appears to be complex. Two models of CR were identified- hypothetico deductive reasoning and narrative reasoning, showing some similarities with CR in human practice.

The role and input of both owner and veterinarian are clearly important and highlight the physiotherapists need to consider them throughout. It was evident that each decision involved consideration of many factors to make the most appropriate decision. In making decisions, a mixture of clinical experience and research evidence was used as support. This study also provides an insight into the assessment and treatment methods currently used by physiotherapists in rehabilitation which has not previously been described. Areas for future research were identified and include suggestions that focus on CR and DM as well as topics such as training aids and exercise which would provide evidence to aid veterinary physiotherapists in their CR and DM.

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## Declaration of interest

The authors report no declarations of interest.

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