Systematic Clinical Reasoning in Physical Therapy (SCRIPT): Tool for the Purposeful Practice of Clinical Reasoning in Orthopedic Manual Physical Therapy

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Background and Purpose. Clinical reasoning is essential to physical therapist practice. Solid clinical reasoning processes may lead to greater understanding of the patient condition, early diagnostic hypothesis development, and well-tolerated examination and intervention strategies, as well as mitigate the risk of diagnostic error. However, the complex and often subconscious nature of clinical reasoning can impede the development of this skill. Protracted tools have been published to help guide self-reflection on clinical reasoning but might not be feasible in typical clinical settings.

Case Description. This case illustrates how the Systematic Clinical Reasoning in Physical Therapy (SCRIPT) tool can be used to guide the clinical reasoning process and prompt a physical therapist to search the literature to answer a clinical question and facilitate formal mentorship sessions in postprofessional physical therapist training programs.

Outcomes. The SCRIPT tool enabled the mentee to generate appropriate hypotheses, plan the examination, query the literature to answer a clinical question, establish a physical therapist diagnosis, and design an effective treatment plan. The SCRIPT tool also facilitated the mentee's clinical reasoning and provided the mentor insight into the mentee's clinical reasoning. The reliability and validity of the SCRIPT tool have not been formally studied.

Discussion. Clinical mentorship is a cornerstone of postprofessional training programs and intended to develop advanced clinical reasoning skills. However, clinical reasoning is often subconscious and, therefore, a challenging skill to develop. The use of a tool such as the SCRIPT may facilitate developing clinical reasoning skills by providing a systematic approach to data gathering and making clinical judgments to bring clinical reasoning to the conscious level, facilitate self-reflection, and make a mentored physical therapist's thought processes explicit to his or her clinical mentor.

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The mentoring process is critical to the physical therapist profession and a requirement of residency and fellowship education. Mentoring in advanced clinical training extends beyond entry-level clinical supervision by guiding and facilitating the mentored physical therapist's continual learning in the development of advanced practice. Clinical mentoring centers on patient management, with an emphasis on developing advanced clinical reasoning and reflective practice skills.[1]

Clinical reasoning is an ongoing decision-making process used throughout the episode of care.[2–6] Sound clinical reasoning, to include using a systematic patient-tailored approach to data gathering and forming early prioritized diagnostic hypotheses,[7] followed by a carefully selected interactive patient history taking and examination to test hypotheses, may reduce cognitive bias and lead to a greater understanding of the patient presentation.[7,8] This greater understanding reduces the risk of diagnostic error and overly aggressive, poorly tolerated physical therapy sessions.[9,10] When clinical reasoning generates diagnostic hypotheses requiring medical management, incorporating best-evidence screening strategies may facilitate timely and appropriate medical care.[11]

Clinical reasoning is more complex than applying an analytical, deductive process.[2–6] Practitioners must engage in analytical and inductive (narrative) thinking that helps uncover important contextual elements that contribute to uncertainty.[3] Practitioners must systematically consider and prioritize variable and uncertain factors, such as understanding the patient's environment, beliefs, and values, as part of the clinical reasoning process, ultimately leading to the ability to make appropriate clinical judgments. The ability to probe deeper with appropriate follow-up questions often stems from a more complete understanding of the patient's story.[12,13] As such, clinical reasoning is best developed within the context of a patient encounter and includes reflecting on previous encounters.[14,15]

Although substantial literature attests to the diagnostic accuracy of physical therapists,[16–19] the inherent complexity of differential diagnosis requires careful, consistent clinical processes. Breakdowns in clinical processes, such as failure to document differential diagnoses, leads to increased incidence of diagnostic error.[9] Clinical reasoning strategies to prevent diagnostic error should focus on systematic data gathering, synthesis, and documentation.[14] Formal training in clinical reasoning facilitates the mental agility to appropriately consider and document alternative diagnostic hypotheses in physical therapist practice.[15] Purposeful practice in reasoning strategies in both didactic and clinical environments is key to developing expertise.[15,20] These advanced clinical skills, combined with a willingness to search the literature for answers to diagnostic questions, may assist appropriate screening and accurate differential diagnosis.[11]

Clinical reasoning is a challenging skill to develop because it is a high-level and typically subconscious cognitive process.[14] Reasoning must be exercised consciously to facilitate self-reflection, change professional behaviors and thought processes, and improve diagnostic accuracy.[3,14,21] Mentors must be present and fully engaged to understand their mentees' thinking as mentees gather and interpret evidence to manage the patient. In other words, mentors need a way for their mentees to "show their math" to make the mentees' thinking explicit. An important learning strategy for making the mentee's thinking more explicit is facilitating reflection.[22,23] Reflection is part of a process of self-monitoring, called meta-cognition or thinking about your thinking.[22,23] A tool that provides a framework for the learner to critically examine his or her thought processes may be an important teaching and learning instrument for facilitating reflection.

The purpose of this case report is to describe the application of a teaching tool developed by an orthopaedic manual physical therapy fellowship program titled the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). In this case, the SCRIPT served as a teaching

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and learning tool for facilitating clinical reasoning within the patient encounter and clinical case analysis in one physical therapy education program. This case report describes: (1) the mentee's management and use of evidence in a patient case and (2) the teaching and learning occurring in the clinical reasoning process.

Case Description

To our knowledge, the only clinical reasoning tool published in the peer-reviewed literature is used in a pediatric residency.[24] Other clinical reasoning forms published in textbooks are detailed, yet lengthy,[21,25] potentially posing challenges to utilizing the form during a typical patient encounter, and may be more useful retrospectively.

In 1994, the Army-Baylor University Doctoral Fellowship Program in Orthopaedic Manual Physical Therapy faculty began developing an expedient tool using a combination of sources, including worksheets from other programs, clinical experience, and examples from a variety of unpublished sources, with feedback from fellows-in-training and other faculty. This tool, titled the SCRIPT, was designed primarily to develop clinical reasoning skills during a patient encounter, appropriately tailor examination and intervention strategies, promote diagnostic accuracy, and assist with planning subsequent patient encounters (eAppendix, available at academic.oup.com/ptj). The form is completed for initial patient encounters during formal one-on-one mentorship sessions between the fellowin- training (mentee) and the fellowshiptrained faculty (mentor) and during subsequent encounters to reflect on initial hypothesis formation and decision making.[26] The SCRIPT is a tool that provides structure for the mentee and insight into the mentee's clinical reasoning process. The SCRIPT also facilitates individual self-reflective practice and guides patient case discussions between physical therapists in clinical and educational settings.

The Process

The SCRIPT facilitates planning and executing a comprehensive, yet well-tolerated, history taking and examination by delineating current symptom intensity and behavior, as well as the most likely and alternate hypotheses for all areas of symptoms. The tool helps prioritize and focus intervention strategies at a dose that is likely to be effective and well-tolerated by the patient, minimizing the potential to irritate painful structures or exacerbate the condition while maximizing the opportunity to understand the patient's problem and achieve the patient's goals.[27] The SCRIPT also may help identify potential pathologies outside the scope of physical therapist practice that need to be screened for and ruled out. When the standard of screening for a diagnostic hypothesis is unknown, a physical therapist should generate appropriate diagnostic questions and search the professional literature for best-evidence screening strategies.[11]

Section I: Guiding Hypothesis Generation and Differential Diagnosis

Section I guides the mentee's hypothesis development and consideration of differential diagnoses early in the patient-physical therapist interaction. After establishing the patient's profile, including age, sex, work, and recreational habits, the mentee gathers information on all areas of symptoms by completing a body chart or symptom map. Accuracy and detail of the body chart, including the location, behavior, character or quality, and intensity of all symptoms, are crucial to understanding the patient's baseline presentation and are the foundation for early comprehensive diagnostic hypothesis generation.

The mentee places a check mark over potentially relevant areas on the body chart that are screened and determined to be asymptomatic. To help prevent misunderstanding, the mentee touches the patient or points to the body region and asks the patient appropriate screening questions such as, "Do you have anything that is not normal or recently changed here?"[25] Determining and documenting relationships between areas of symptoms on the body chart is helpful to hypothesis formation and the differential diagnosis process. For example, when a "primary concern" area of symptoms (labeled as P1), such as mid-lumbar pain, increases, a secondary area of symptoms (labeled as P2), such as lateral thigh pain, also might increase, thereby suggesting the 2 areas of symptoms are related.[25]

A novice physical therapist might mistakenly assume that patients will indicate all areas of symptoms on a body chart and that any other body region is symptom-free.[2] Additionally, a novice physical therapist might limit gathering the history and body chart information to only one area of symptoms.[2] Reasons for this decision could include time limitations, an attempt to focus on the areas of symptoms for which the patient was referred for physical therapy, or to mitigate a sense of being overwhelmed in complex cases or cases with multiple areas of symptoms. This rather limited approach could hinder the physical therapist's ability to recognize relationships between areas of symptoms[2] or patterns indicative of nonmusculoskeletal conditions, such as systemic illness. Pattern recognition may assist experienced physical therapists with early hypothesis formation.[28] However, a physical therapist working solely from pattern recognition of common causes in cases such as this might assume[21] that all cases of back and concurrent leg pain are of the same origin and overlook other potential sources of unrelated leg pain, such as tumor, deep venous pathology, peripheral neuritis, or a distinct local musculoskeletal problem. Expert clinicians may use pattern recognition in the differential diagnosis process but also must maintain an open mind and a willingness to generate, document, and systematically test multiple alternative hypotheses.[7,18,21,29,30]

The flow of the typical formal mentorship session is illustrated in Figure 1. After completing the body chart, the first of two 5- to 10-minute pauses occurs away from the patient to allow the mentee to complete section I of the SCRIPT. These pauses are critical to clinical mentorship, enabling the mentee to reflect on action,[6] plan the remaining examination, ask the mentor questions, and gain guidance. This approach also provides an opportunity for the mentor to gain insight into the mentee's clinical reasoning, reinforce their positive decisions, and make suggestions and pose ques-

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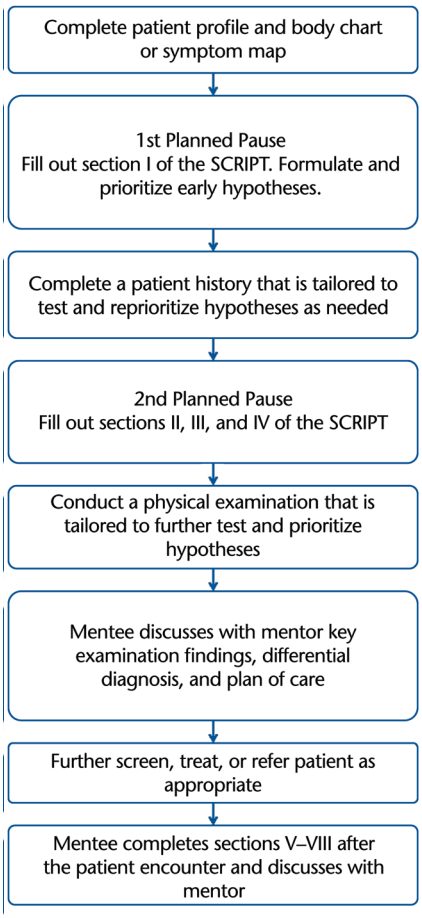

Figure 1.
Flow diagram of how to use the Systematic Clinical Reasoning in Physical Therapy (SCRIPT) tool during a mentorship session.

tions to highlight alternatives in reasoning.

The mentee lists all structures that must be considered as possible sources of the patient's symptoms, to include joints and bony structures; muscles, tendons, and soft tissue structures; structures that may refer symptoms into the area of concern; and other structures or conditions that must be considered or ruled out, such as visceral pathology, infections, space-occupying lesions, and systemic non-musculoskeletal pathology. This proactive planning makes explicit the connections between thinking and future actions.

After completing section I, the mentee formalizes his or her differential thought by generating and prioritizing the most likely, less likely, and remote hypotheses in section II of the SCRIPT. The mentor reviews the form with the mentee, providing immediate feedback and helping to refine or provide additional hypotheses.[31] The mentor ensures that the mentee has a plan to effectively utilize the remaining patient history to refine and prioritize competing hypotheses with carefully selected and formulated questions and to determine likely symptom behavior during the physical examination and intervention. Hypotheses derived and prioritized during the history taking are subsequently examined with appropriate tests and measures, and later by the patient's response to intervention, thereby requiring both deductive (analytical) and inductive thinking.

During a mentorship session, the second planned pause occurs at the conclusion of the history taking for the mentee to complete sections II, III, and IV of the SCRIPT.

Section II: Making Clinical Judgments

Section II requires judgments on the constructs of severity and irritability of symptoms and nature, stage, and stability of the disorder, collectively referred to as SINSS.[25] The SINSS, initially described by Maitland and elaborated on by various other authors,[25,32,33] are evaluated for each symptomatic area, as different areas of symptoms may have different symptom behavior and possibly different origins (Fig. 2). The SINSS are determined by analyzing information gathered during the history taking.[25,32,33] This concept helps determine the extent and vigor of the examination and treatment that are likely to be well-tolerated.[27,33] For example, if a mentee judges a patient's symptoms to be severe (high intensity) and irritable (easily provoked and persisting), the examination should be limited to the first onset or increase of symptoms, and the overall number of examination procedures should be reduced accordingly.[25] Conversely, a patient whose symptoms display mild severity and irritability might tolerate examination including provocative diagnostic special tests, manual examination to end of range of motion (ROM), and combined or repeated motions.[34–36] The nature of the disorder is a multifactorial judgment based on the mentee's perception of unique factors associated with the probable condition, such as typical musculoskeletal origin, nontypical presentation requiring screening, complex disorders (eg, whiplash, acute radiculitis), and personal factors (eg, being a single working parent, exhibiting high fear-avoidance behavior).[25,32,37] *Stage* refers to the duration of symptoms, classified as acute, subacute, or chronic or a combination of stages (eg, acute and chronic).[25,32] Stage can be an important factor directly related to the nature of the problem, particularly in disorders with healing tissues or inflammatory processes. Stability may be characterized as a sign or symptom improving, worsening, or not changing over the course of the present episode or previous episodes.[25,32]

Section III: Considering Additional Contributing Factors

Completing section III prompts the mentee to consider additional factors contributing to the patient's condition, such as poor conditioning or psychosocial factors, that may change the prognosis or require therapeutic attention. These factors are considerations but should not be overly weighted in the differential diagnosis process. A patient with deconditioning or psychosocial issues would have as many possible sources of symptoms as a patient who is more physically fit or emotionally stable, and those possible sources should be systematically considered and ruled out.[38] This patient, however, did not display contributing factors that required additional consideration.

Sections IV and V: Planning the Examination

Section IV provides a flexible framework for planning the examination. The mentee refers to the hypotheses in section I and reprioritizes the most likely hypotheses based on information obtained during the remainder of the history taking. Tests and measures typically prioritized and selected for the initial examination provide essential evaluation of the most likely hypotheses and rule out potentially serious conditions (Fig. 3). The vigor of the examination is strongly influenced by

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II. INFLUENCE OF THE SYMPTOMS ON THE EXAM. Detailed by Area of Symptoms as Mapped on Body Chart.

Px	Severity	Irritability	Nature	Stage	Stability	Limit Exam
P1	Moderate	Mild	MSK, postsurgical, degenerative	Chronic	Not changing	N
P2	Mild–moderate	Mild	MSK, nerve, possible systemic disease contribution	Chronic	Worsening	N
P3	Mild–moderate	Mild	MSK, nerve, possible systemic disease contribution	Chronic	Worsening	N
	Mild Moderate Severe	**Mild Moderate Severe**	**(Healing, fragile tissues, inflammatory, psychosocial) Non-MSK/MSK/both**	**Acute, subacute, chronic Acute on chronic Subacute on chronic**	**Improving ↑ Worsening ↓ Not changing**	**Yes=Y No=N**

What will be the vigor of your exam?	P1	P2	P3	Do the nature, diagnosis, or comorbidities warrant special caution for exam or treatment?
Examine to first onset or change in pain				What? Y/N (eg, trauma/red flags/instability/pathological process) No
Examine to end of active range of motion/ACTIVE limit	X			
Examine to end of passive range of motion/PASSIVE limit				Which symptoms will be desirable to reproduce? Back pain (P1) and peripheral symptoms (P2 and P3)
Examine with OVERPRESSURE sufficient to determine end feel				Do you expect a comparable sign to be EASY or HARD to reproduce? Easy in lumbar spine, hard in periphery
Use sustained, repeated, or combined movements		X	X	What do you expect to be treating? (Circle one) PAIN RESISTANCE RESPECTING PAIN RESISTANCE

Figure 2.
Section II of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). MSK=musculoskeletal, Px=area of symptoms, P1=primary area of symptoms, P2=secondary area of symptoms, P3=tertiary area of symptoms.

the judged SINSS of the patient's symptoms. The examination also is used to identify impairments amenable to physical therapy interventions. Relevant examination procedures deferred during the initial examination should be documented and prioritized for completion in subsequent sessions.

Sections VI–VIII: Recording, Reprioritizing, and Making the Prognosis

Prior to implementing treatment, the mentee communicates to the mentor the mentee's differential diagnosis, key examination findings, and plan of care while in front of the patient. The mentor provides any immediate feedback or guidance and may assist in treatment as needed. Sections VI through VIII are completed at the conclusion of the initial patient encounter. Section VI is used to record the intervention, patient response, and prescribed reinforcing exercises. In section VII, the mentee applies deductive and inductive thinking to reprioritize the hypotheses based on the supporting evidence accumulated during the examination and treatment. The mentee then quickly reassesses whether there has been any change in SINSS or additional screening is needed. Finally, the mentee records important baseline findings from the patient's history and examination that should be rechecked at subsequent visits to accurately determine the patient's response to intervention. In section VIII, the mentee records prognostic information. If a patient is not responding according to the prognosis evidence and the mentee's clinical experience, further consideration of alternate hypotheses, additional examination, or more formal screening may be warranted. The mentee's ability to assess a patient's response to intervention in order to test diagnostic hypotheses, combined with the ability to examine and treat patients over multiple clinical sessions, should improve diagnostic accuracy, particularly when clinical reasoning is utilized throughout the episode of care.[10,11]

Application of the Process

We present a patient case where the SCRIPT guided the clinical reasoning process during a patient encounter with a 64-year-old retired man who was referred by a physician for physical therapy with a diagnosis of axial back pain. The patient reported a primary complaint of chronic lower back pain (LBP) and a secondary complaint of bilateral plantar foot tingling. The care of this patient met Health Insurance Portability and Accountability Act (HIPAA) requirements of the institution for disclosure of protected health information.

In the case example below, the patient identified his primary complaint as a constant, but variable in intensity, deep ache or stiffness in his central lower lumbar spine (P1) (Fig. 4). He also described deep, constant tingling of variable intensity on the plantar surfaces of both feet, more pronounced in the right foot (P2) than the left foot (P3). The patient reported that there was no relationship among the areas of symptoms.

Using the information from section I, the mentee considered degenerative disk disease with central or bilateral foraminal stenosis as the most likely hypotheses. The mentee judged chronic lower lumbar dysfunction with a separate peripheral neuropathic disease (PND) to be a less likely hypothesis. The mentee tailored the history to further test the most likely and alternative hypotheses (Fig. 4).

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IV. PLANNED EXAM PROCEDURES: Prioritize based on most likely hypotheses and SINSS.		
Day/Visit 1 Lumbar AROM, LE neurological exam, SLR, palpation exam of lumbar spine, segmental mobility of lumbar spine	**Day/Visit 2** MNSI: inspection of feet, vibration Slump test for neural tension symptoms Prone knee bend to assess anterior hip structure flexibility	**Day/Visit 3** Repeated motions to assess for centralization/peripheralization Clear hip/SIJ

Figure 3.
Section IV of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). SINSS=severity, irritability, nature, stage, stability; AROM=active range of motion; LE=lower extremity; SLR=straight leg raise; MNSI=Michigan Neuropathy Screening Instrument, SIJ=sacroiliac joint.

The patient's history revealed previous bilateral L3–L5 hemilaminectomy procedures and lateral recess decompression for spinal stenosis 1 year prior, with no effect on the feet tingling. Therefore, stenosis did not seem likely to be the primary cause of his tingling. Additionally, the patient had medically managed type 2 diabetes mellitus. As PND is prevalent in the diabetic population and neurological symptoms associated with this condition may be similar to those seen with a variety of lumbar conditions, the alternative hypothesis of PND could not be ruled out and was documented on the SCRIPT.[39] Other potential sources of LBP, such as neoplasm, infection, or aortic abdominal aneurysm, were judged to be remote hypotheses for this 64-year-old immunocompetent patient who had never smoked and was without general health changes and, therefore, did not require additional screening at this point.

During the history taking, the patient reported unchanging LBP for 2 years and bilateral foot tingling for 4 to 5 years, but that these symptoms had worsened in intensity and frequency over the past year. His LBP and tingling both increased after standing for 30 minutes and eased with walking for 10 minutes. He used Celebrex (Pfizer Inc, New York, New York) daily for his LBP and Percocet (Endo Pharmaceuticals Inc, Malvern, Pennsylvania) occasionally for breakthrough pain. His sleep and activities of daily living were not limited. Therefore, the mentee judged the severity of his LBP as mild to moderate and the severity of his irritability as mild. The LBP seemed mechanical in nature, whereas the foot tingling seemed to change more than the back symptoms, suggesting that it was less stable and potentially of a different origin than the LBP. Due to the overall mild severity and irritability, the mentee decided to examine the patient to the extent necessary to elicit all areas of symptoms. A neurological screening also was deemed necessary due to the presence of peripheral tingling.

The examination planned for this case included neurological screening, lumbar ROM testing, soft tissue and lumbar mobility assessment, and neural tension tests. Standing lumbar extension active ROM was limited, with increased LBP at end range that quickly returned to baseline upon return to neutral. The neurological screening demonstrated reduced right ankle reflex, reduced sensation on the right plantar foot and heel to light touch, and absent Babinski and clonus tests. Bilateral lower extremities demonstrated 5/5 strength in L2–S1 myotomes. Passive mobility assessment of the lumbar spine demonstrated hypomobility and localized pain, with central and right unilateral posterior-to-anterior mid-range mobilization at L3–L5, but did not affect the patient's foot tingling, nor did active ROM testing of the lumbar spine. Bilateral straight-leg-raising tests with sensitizing maneuvers did not reproduce or change lower extremity symptoms. Although it seemed likely based on these findings that the LBP and the neurological symptoms were of distinct origins, the examination did not adequately distinguish between the 2 hypotheses. Given the diagnostic uncertainty, the mentee chose to use the patient's response to lumbar intervention to help determine the relationship between the LBP and foot tingling.

Interview and physical examination findings are documented in the patient record, and key findings are marked with asterisk signs to denote them as important parts of the baseline presentation. These key findings are frequently reexamined to determine patient response to examination and treatment. These key baseline findings are recorded in section V of the SCRIPT (Fig. 5).

In this case, manual treatment with reinforcing exercise was initiated to address impaired lumbar spine extension. Because the key finding of lumbar symptoms during passive mobility assessment of the L3 vertebral segment was most comparable with the patient's primary complaint, treatment at the initial visit consisted of six 30-second bouts of grade IV central posterior-to-anterior mobilizations directed to the L3 vertebral segment, followed by supine pelvic rocking motions in a painless ROM. After treatment, the patient's lumbar extension and pain were moderately improved, but the tingling remained unchanged (Fig. 6). The prognosis of long-standing sensory changes suggested it may be difficult to influence these symptoms in one treatment session, further contributing to diagnostic uncertainty.

The diagnostic uncertainty at the end of the initial examination and the documented alternative hypotheses noted in section VII of the SCRIPT warranted additional screening for the cause of the foot tingling before completing sections VII and VIII of the SCRIPT. Peripheral neuropathy in patients with diabetes increases the risk of foot ulceration and infection by up to 7-fold,[34] highlighting the importance of early identification. Therefore, the mentee performed a literature search[11] to find the best screening strategies to answer the following clinical question: "In a 64-year-old man with type 2 diabetes and chronic LBP, what is the best way to screen for a diabetic PND as the source of plantar foot tingling?"

Clinical practice guidelines recommend using a cluster of tests to screen for dia-

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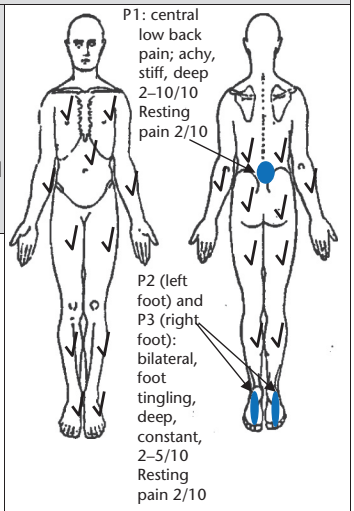
I. WHAT AREAS/STRUCTURES MUST BE CONSIDERED AS POSSIBLE SOURCE(S) OF SYMPTOMS?

Joints and bony structures UNDER the area of symptoms	Muscles, tendons, and other soft tissue UNDER and IN the area of symptoms	Pain-producing structures that may REFER into the area of symptom	OTHER structures or conditions that must be considered or ruled out
-Bilateral lower lumbar facet joints -Bilateral lower lumbar vertebral joints -Bilateral ilium -Sacrum -Bilateral sacroiliac joints -Bilateral hindfoot joints -Bilateral tarsal joints -Bilateral tarsometatarsal joints -Bilateral metatarsal phalangeal joints	-Lower lumbar paravertebral muscles -Bilateral quadratus lumborum muscles -Bilateral proximal gluteal muscles -Bilateral foot intrinsic muscles -Bilateral plantar fascia -Bilateral lower extremity peripheral nerves (tibial, deep/superficial fibular, medial/lateral plantar)	-Lower thoracic spine -Upper lumbar spine Mid lumbar spine -Upper, mid, and lower lumbar disks -Bilateral sacroiliac joints -Bilateral hip joints -Bilateral talocrural joints	- Lower extremity vascular - GI system - GU system - Space-occupying lesion (tumor) - Spinal infection



Most Likely Hypotheses:	Less Likely Hypotheses:	Remote Hypotheses:
• Chronic central lower lumbar dysfunction with bilateral radiculopathy/radiculitis, most likely of S1 nerve root • Chronic central lower lumbar dysfunction with peripheral neuropathic disease (polyneuropathy or mononeuropathy)	• Spinal stenosis with neurogenic claudication • Myofascial pain status post lumbar surgery with bilateral chronic neural tension symptoms	• Space-occupying lesion in the lumbar spine • Lower extremity or abdominal vascular pathology • Referred pain from viscerogenic pathology • Spinal infection

Figure 4.
Section I of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). GI=gastrointestinal, GU=genitourinary, P1=primary area of symptoms, P2=secondary area of symptoms, P3=tertiary area of symptoms.

betic neuropathy, including foot and lower limb inspection and sensory testing.[35] The literature indicated that the Michigan Neuropathy Screening Instrument (MNSI), consisting of a foot inspection, ankle reflexes, and vibration perception, has been validated in the type 2 diabetic population as a screening tool for diabetic PND.[36] A score of ≥2 has a specificity of 83% (95% confidence interval=75%, 89%) and a positive likelihood ratio of 3.9 (95% confidence interval=2.5, 6.1), suggesting that further quantitative neurological testing was appropriate.[36]

Based on the literature, the mentee planned to administer the MNSI at the following visit to further differentiate the genesis of the peripheral symptoms (Fig. 7). Subsequent examination demonstrated a reduced ankle reflex on the right and absent vibratory sense at both ankles, resulting in an MNSI score of 2.5 and the need for further screening. The diagnostic gold standard for diabetic PND is electromyography and nerve conduction study (EMG/NCS) testing.[34] Due to the patient's complaints of worsening lower extremity neurological symptoms, the physical therapist communicated with the patient's primary care provider, who ordered EMG/NCS testing.

The EMG/NCS testing demonstrated mild demyelinating PND affecting the sensory and motor fibers in the lower extremities, as well as evidence of chronic bilateral L5 and S1 radiculopathies that did not warrant surgical intervention. This knowledge helped the mentee determine the likely clinical diagnoses and overall prognosis (Fig. 7). Physical therapy treatment would likely influence the patient's chronic LBP more than the chronic neurological symptoms. However, understanding the contributions of the diabetic PND to the patient's symptoms enabled the mentee to provide appropriate patient education, devise a treatment plan respective of the patient's comorbidity and reconnect the patient with his primary care provider for continued medical management.

In accordance with the *Guide to Physical Therapist Practice*,[37] the appropriate clinical care for this patient included treating the LBP consistent with best-evidence strategies and referring the patient for further evaluation of his PND. The data from the SCRIPT helped guide clinical reasoning and plan management throughout the episode of care.

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V. EXAM FINDINGS	
Important baseline findings from patient history:	**Important baseline exam findings:**
Stand >30 min produces back and peripheral symptoms	Reduced reflex right ankle, reduced sensation to light touch in right plantar foot
Walk >15–30 min produces peripheral symptoms	Standing lumbar extension 10%, 5/10 pain

Figure 5.
Section V of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT).

Outcome

Utilizing the SCRIPT tool enabled the mentee to generate appropriate hypotheses and create an examination plan to systematically test the hypotheses, ultimately leading the mentee to query the literature to answer a clinical question, establish a physical therapy diagnosis, and design a treatment plan that entailed continued physical therapy to address the patient's LBP and a referral to the patient's primary care provider for continued management of the PND. The patient elected to continue physical therapy at another clinic closer to his home, so no additional information is known about subsequent physical therapy intervention or changes in his symptoms associated with the treatment that he received. In addition to facilitating the mentee's clinical reasoning processes to establish a diagnosis and plan of care, the SCRIPT tool provided the mentor with insight into the mentee's clinical reasoning. Although the SCRIPT was beneficial in the clinical reasoning and mentoring processes for this patient case, the reliability and validity of the SCRIPT tool have not been formally studied. Future research is needed to examine the usefulness of the SCRIPT in the postprofessional academic setting.

Discussion

This case illustrates how the SCRIPT guided the clinical reasoning process for a patient with symptoms commonly seen in an outpatient physical therapy practice. Using the SCRIPT to identify a spectrum of potentially involved structures enabled the mentee to consider alternative diagnostic hypotheses. The SCRIPT provided the mentee with a systematic way to gather information to guide clinical reasoning and reflection while also providing the mentor with valuable insight to help usher the mentee's clinical reasoning to the level of an expert clinician.[40] Additionally, the tool spurred the mentee to search the literature when the origin of the foot tingling was unclear and more information was needed to evaluate potential alternative hypotheses. Although not rapidly progressing or life threatening, this systemic nerve condition will likely require medical management and influences the patient's overall prognosis. Physical therapists in all settings should be able to search, find, and apply or recommend screening strategies when clinical reasoning suggests they are appropriate. The SCRIPT provides a systematic means of considering examination-derived data for the purpose of formulating diagnostic hypotheses and determining the appropriate scope and vigor of the examination and intervention. In this case, the SCRIPT guided the mentee to conduct an initial intervention that allowed the patient to leave the clinic with less LBP while providing the mentee with diagnostically helpful information of unchanged symptoms in the patient's feet, facilitating the appropriate additional screening.

Published clinical reasoning tools are available for pediatric physical therapist practice.[24,41] To our knowledge, the peer-reviewed literature does not have a tool to guide clinical reasoning in other areas of practice. The SCRIPT could be used to teach and structure clinical reasoning for a number of educational and professional development activities, such as clinical mentorship, case-based tutorial sessions, new-employee orientation and mentorship,[42] assessing a physical therapist's clinical reasoning skills,[42] and self-reflective practice.

The SCRIPT provides a framework for developing clinical reasoning for use throughout the patient encounter. Structured processes to develop clinical reasoning skills improve the differential diagnosis process,[2] reduce the risk of diagnostic error,[9] and facilitate well-tolerated examination and intervention strategies.[9,25] Similar to Atkinson and Nixon-Cave's[24] pediatric clinical reasoning tool, additional research is needed to demonstrate the SCRIPT's influence on clinical reasoning thought processes, utility in developing a novice to an expert clinician, and effectiveness as an aid to reflective practice. It ultimately may be useful in a variety of academic and clinical settings.

As with any tool, however, the SCRIPT has its limitations and challenges. Born out of a manual physical therapy fellowship program, the verbiage in the SCRIPT is biased toward the typical practice pat-

VI. TREATMENT PROVIDED					
Manual Therapy Treatment	**Direction**	**Grade**	**Amount**	**Duration**	**Reinforcing Exercises:**
1st L3	Central posterior-anterior	IV	3 reps	30 s	Pelvic anterior and posterior rocks in hook-lying position
2nd L3	Central posterior-anterior	IV	3 reps	30 s	**Response to Treatment:** Lumbar extension movement was symmetrical to 25% of the range before limited by 2–3/10 low back pain. No effect on peripheral symptoms.

Figure 6.
Section VI of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). Grade IV=50% of normal movement within resistance, reps=repetitions.

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VII. ASSESSMENT END OF DAY 1	
Most Likely Hypothesis: Chronic central lower lumbar dysfunction with peripheral neuropathic disease (polyneuropathy or mononeuropathy) **Supporting Evidence:** Lumbar exam and treatment did not change peripheral symptoms, potentially pointing to 2 separate origins of symptoms. Central technique applied to lumbar spine improved lumbar symptoms. Reduced reflex in right ankle, reduced sensation to light touch in right plantar foot. Absence of motor weakness in S1 myotome.	**Alternate Hypotheses:** Chronic central lower lumbar dysfunction with bilateral radiculopathy/radiculitis, most likely of S1 nerve root. **Supporting Evidence:** Central technique applied to lumbar spine improved lumbar symptoms. Long-standing sensory changes associated with radiculopathy may be difficult to influence in one visit, limiting ability to exclude a root-level lesion. Peripheral symptoms in S1 dermatomal pattern. Reduced reflex in right ankle, reduced sensation to light touch in right plantar foot.
Has there been a change in your assessment of SINSS? What? No	
Is there a need for additional screening? What? Why? Yes, diagnostic uncertainty at end of initial evaluation; risk of ulceration and infection in patients with diabetic neuropathy. MNSI is warranted.	

VIII. PROGNOSIS		
What is the natural history of the disorder? Chronic, progressive lumbar pain with uncertainty surrounding peripheral symptoms		
Expected level and rate of recovery based on evidence for prognosis: **Short Term:** Stand 45 min without worsening back pain. **Long Term:** Walk 45 min without worsening back or foot symptoms.		
How many visits over what period of time do you expect to see this patient? 6–8 visits over 4 wk		
Factors that may limit rate or extent of recovery: History of diabetes mellitus and associated limited ability to heal. Two back surgeries with minimal change in lumbar pain.		
Likelihood of recurrence: MILD/MODERATE/HIGH		
How will you attempt to prevent a recurrence of symptoms? Patient education, maintenance HEP of lumbar mobility and strengthening exercises, regular low-impact aerobic exercise		
At the next visit, what treatment will you choose if the patient is:		
Better: Progress depth of CPA mobilization at L3, increase number of bouts of treatment.	**Same:** Continue and progress central PA mobilization at L3. Layer in CPA at additional levels (L4, L5).	**Worse:** Layer in CPA at adjacent levels (L2, L4). Defer CPA at L3.

Figure 7.
Sections VII and VIII of the Systematic Clinical Reasoning in Physical Therapy (SCRIPT). SINSS=severity, irritability, nature, stage, stability; MNSI=Michigan Neuropathy Screening Instrument; HEP=home exercise program; CPA=central posterior to anterior.

terns of a manual physical therapist and utilizes verbiage best known from Maitland's work.[25] Additionally, utilizing a tool such as the SCRIPT requires dedicated time and effort, which may prove to be obstacles to its utilization in typical clinical practice. Our program allots 90 minutes to an initial evaluation in order to allow for the 2 planned pauses away from the patient and the ongoing discussion between the mentee and mentor during the examination and treatment. It may be of benefit to have a third planned pause after the examination to discuss key findings, reprioritize diagnostic hypotheses, and plan treatment. This third planned pause may be well worth the additional cost of time for novices or mentees who the mentor identifies as struggling with a particular patient encounter. Lastly, although the SCRIPT attempts to concisely marry the hypothetico-deductive reasoning strategies with narrative reasoning, the SCRIPT is not an exhaustive tool. A more meticulous tool may be necessary for a more novice physical therapist. For example, the SCRIPT attempts to help identify relevant psychosocial factors but does not inherently prompt an in-depth examination of such factors.

The development of clinical reasoning skills is a defining feature of residency and fellowship education[1] and central to developing expertise. Expertise is not a status solely acquired through residency or fellowship education but is a process of continued development. An expert's career advances through continuous learning and progressive problem solving, a process called "adaptive expertise."[43] Meta-cognition is a critical element of progressive problem solving[44,45]; some authors[22,46] argue that this is the most important component of professional competence.

Expert clinicians differ from novices with respect to their use of clinical reasoning strategies and their ability and willingness to consider, document, and test alternate hypotheses and to control the environment of the patient encounter.[3,5,21,28,40] Mentorship in residency and fellowship programs is paramount to the development of advanced clinical reasoning skills and developing expertise,[1] yet we have much to understand and discover in the teaching and learning process for developing clinical reasoning skills. Clinical reasoning tools, such as the SCRIPT, may help clinicians develop consistent clinical processes that aid in the differential diagnosis process. Residency and fellowship education with this central focus on clinical reasoning is a rich environment for continued research.[47,48]

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