London College of Animal Osteopathy

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Giving the Horse a Voice: An Osteopathic Exploration of Behavioural Coping Styles, Autonomic Regulation and Somatic Dysfunction Using the Parelli Horsenality Framework

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Abstract

Equine behaviour is most commonly interpreted through the lens of temperament, training and performance; however, increasing evidence suggests that behavioural expression may also reflect underlying neurophysiological and biomechanical adaptation. Being prey animals, horses often mask signs of weakness or discomfort, meaning that subtle behavioural, postural and movement changes can indicate stress, pain or dysfunction before lameness becomes evident. This literature-based thesis explores the relationship between behavioural coping styles and autonomic regulation, breathing mechanics, fascial tension and somatic dysfunction from an osteopathic perspective. Using the Parelli Horsenality framework as an observational lens, the discussion integrates osteopathic philosophy, neurophysiology, fascial research and equine behaviour to examine how altered autonomic activity may influence posture, movement and compensatory patterns. Due to the limited peer-reviewed research directly linking behavioural coping styles with specific osteopathic findings in horses, the scope of this thesis is necessarily theoretical and exploratory. This thesis proposes that behavioural expression may provide clinically relevant insight into the adaptive neurophysiological and biomechanical states of the horse.

Introduction

Horses evolved as social herd animals and primarily communicate through complex body language, using behavioural expression, physical posture and movement (Ladewig, 2019). Fundamentally being prey animals, their instincts and evolutionary adaptations predispose them towards heightened awareness and rapid flight responses to perceived threats, where they often display subtle behavioural or postural cues before lameness becomes clinically evident (Dyson et al., 2018; König von Borstel et al., 2017). Due to this natural instinct, presenting lameness is a last resort; horses instead provide subtle changes to the trained eye, including behavioural and postural cues that may represent early indicators of stress or dysfunction (Lencioni et al., 2021).

Within the equine industry, viewing behaviour through the lens of temperament or training is common practice. However, increasing research into equine stress physiology, pain behaviour and biomechanics suggests that behavioural expression may also reflect underlying neurophysiological and biomechanical adaptation, rather than simply representing a reactive, stubborn or shut-down horse (König von Borstel et al., 2017; Lencioni et al., 2021). Chronic stress responses may become physically embodied through altered neuromuscular recruitment, fascial tension, breathing adaptation and compensatory postural strategies.

Osteopathy considers the horse as an integrated organism in which structure and function are interrelated, and in which body, mind and physiological regulation are viewed as interconnected (American Osteopathic Association, 2010; Chila, 2011). Through the osteopathic lens, chronic stress, pain and altered autonomic regulation have the potential to alter breathing, posture, muscle tone and fascial tension, contributing to compensatory patterns and ultimately somatic dysfunction (Hodges & Tucker, 2011; Schleip et al., 2012). General fascial research further supports a whole-body perspective, demonstrating that connective tissues play a role in force transmission and mechanosensory communication throughout the organism (Schleip et al., 2012).

The Parelli Horsenality framework, developed by Pat and Linda Parelli, provides a practitioner-derived observational model categorising horses based on introverted or extroverted and left-brain or right-brain behavioural tendencies (Parelli & Parelli, 2011). While this framework lacks independent peer-reviewed validation as a diagnostic classification system, it offers a useful descriptive lens through which recurring behavioural coping strategies can be explored osteopathically (Kirchhoff, 2018). The scope of this thesis is accordingly theoretical; due to the literature-based methodology and limited direct research linking specific behavioural coping styles with defined osteopathic findings in horses, the discussions presented constitute exploratory propositions rather than clinical conclusions.

The aim of this thesis is to explore how behavioural coping styles may be associated with autonomic regulation, breathing mechanics, fascial tension and somatic dysfunction from an osteopathic perspective, examining whether behavioural expression can provide clinically relevant insight into the adaptive neurophysiological and biomechanical state of the horse.

It is hypothesised that distinct behavioural coping styles, as described by the Horsenality framework, may reflect identifiable patterns of autonomic regulation and somatic adaptation that are clinically relevant to osteopathic assessment.

Osteopathic Principles and Philosophy

In 1874, Andrew Taylor Still developed osteopathy as a holistic system founded on the principle that the body functions as an integrated and interconnected unit in which structure and function work reciprocally (Chila, 2011; Still, 1899). Four core principles underpin this approach.

First, the body is a unit: all systems - musculoskeletal, neurological, circulatory, respiratory and behavioural - function interdependently to maintain homeostasis (Chila, 2011). Dysfunction in one system therefore influences the function of another. Behavioural changes may not solely represent temperament, but may also reflect underlying physiological or biomechanical stress. Second, structure and function are interrelated: repeated behavioural coping mechanisms and chronic autonomic states may progressively influence physical structure and movement organisation. Equally, chronic physical dysfunction, pain or restriction may influence behavioural expression through altered proprioception, nociception and nervous system sensitisation (Chila, 2011). Third, the body has an innate capacity for self-regulation and self-healing through homeostasis (Still, 1899). Adaptive capacity is maintained while stressors remain within manageable thresholds; dysfunction emerges when this capacity is continuously overwhelmed. Unobstructed circulation of blood and lymphatic fluids is essential to this process, as chronic tissue tension may negatively affect local circulation and tissue function. Finally, rational treatment is patient-centred, incorporating all three preceding principles alongside an understanding of the individual's stressors (Chila, 2011).

Osteopathic clinical reasoning also utilises five conceptual models: the biomechanical, neurological, respiratory-circulatory, metabolic-energy and behavioural models (Seffinger et al., 2003). The biomechanical model examines posture, force distribution, movement and stress-related behaviour; the neurological model considers spinal facilitation, proprioceptive function, autonomic regulation and nociceptive activity; the respiratory-circulatory model emphasises the role of breathing mechanics and fluid dynamics in maintaining tissue health; the metabolic-energy model deals with metabolic regulation, endocrine balance and energy expenditure; and the behavioural model highlights the influence of internal and external environments on the horse's wellbeing. Integrating these models across this thesis allows behaviour, physiology and movement patterns to be examined as interconnected adaptive processes.

Approach to Research

This thesis adopts an integrative literature-based approach, bringing together osteopathic philosophy, equine behaviour research, neurophysiology and fascial concepts to explore the relationship between stress, behaviour and postural adaptation in horses. As there is currently limited direct research connecting behavioural coping styles with osteopathic findings in horses, theoretical synthesis was used to develop clinical reasoning within this emerging area of animal osteopathy (Chila, 2011). More practical research methods, such as case studies or observational studies, were not chosen because the evidence base is still developing to support them at this stage, and integrative theoretical synthesis is an accepted methodology in emerging clinical fields.

Somatic Dysfunction and Neurophysiology

Somatic dysfunction is defined as "an altered or impaired function of components of the somatic (body framework) systems: skeletal, arthrodial and myofascial structures and related vascular, lymphatic and neural elements" (American Osteopathic Association, 2010, p. 1249). Four criteria identify somatic dysfunction - tissue texture changes, asymmetry, restriction of motion and tenderness (TART) - which in horses may manifest as postural change, compensatory movement patterns, muscular guarding and decreased mobility.

Korr's facilitated segment theory proposes that persistent nociceptive input leads to chronic spinal cord facilitation and heightened excitability of associated neural pathways, which then require less stimulus to trigger a reaction (Korr, 1976). This heightened state contributes to increased muscle tension, tenderness, altered proprioceptive feedback and chronic sympathetic activation. From an osteopathic perspective, ongoing or prolonged stress and pain can therefore perpetuate dysfunctional patterns and reduce the body's adaptive capacity.

Proprioception plays an important role in maintaining posture and coordinated movement, providing information about body part position through mechanoreceptors, including muscle spindles, joint receptors and Golgi tendon organs (Matthews, 1964). These receptors relay information regarding tension, movement and body position (Schleip et al., 2012). Altered proprioceptive input associated with pain or dysfunction can contribute to poor motor control and chronic muscular guarding (Hodges & Tucker, 2011). Nociceptive and proprioceptive information is continuously transmitted through ascending spinal pathways to higher autonomic and emotional processing centres, while descending neural pathways simultaneously influence muscle tone, postural regulation and autonomic output. Consequently, behavioural responses, emotional stress and physical adaptation cannot be viewed independently (Porges, 2011; Taylor, 2002).

Chronic autonomic activation may also influence neuromuscular recruitment patterns and motor control. When stress responses become repetitive, the body may increasingly rely on protective stabilisation strategies. Over time, these patterns may become neurologically reinforced through repetitive nociceptive input and facilitated spinal reflex activity, reducing movement variability as the horse becomes biomechanically organised around protection rather than adaptability (Hodges & Tucker, 2011; Korr, 1976).

Autonomic Nervous System, Stress Responses and Breathing

The autonomic nervous system (ANS) consists of the sympathetic and parasympathetic divisions, operating unconsciously to maintain internal homeostasis by regulating physiological and behavioural responses to environmental stressors (Porges, 2011). Sympathetic activation prepares the body for fight-or-flight responses through increased heart rate, elevated respiratory rate, redistribution of blood flow toward skeletal muscle and heightened neuromuscular readiness (Fazio et al., 2013; Stucke et al., 2015). Persistent sympathetic dominance may contribute to chronic muscular bracing, altered motor recruitment patterns, shallow respiration and reduced movement variability (Hodges &

Tucker, 2011). In contrast, parasympathetic regulation supports tissue restoration, respiratory efficiency and recovery (Porges, 2011).

Rather than displaying outward hyperreactivity, some chronically stressed horses may demonstrate behavioural withdrawal, immobility and conservation-based movement strategies, despite remaining internally dysregulated, which have been conceptually compared to freeze-type autonomic responses described within Polyvagal Theory (Fureix et al., 2012; Porges, 2011).

Autonomic state is closely linked to breathing mechanics. Stress alters breathing patterns, producing shallower respiration, breath-holding and reduced diaphragmatic excursion (Bordoni & Zanier, 2013). The diaphragm plays a critical role not only in respiration and gas exchange but also in postural stability, thoracic mobility and pressure regulation throughout the whole body. Anatomically, autonomic pathways are closely associated with the cervical region, thoracic inlet, diaphragm and thoracolumbar junction - regions commonly evaluated osteopathically (Chila, 2011; König & Liebich, 2020). Chronic tension surrounding these regions may therefore influence both biomechanical and autonomic regulation through altered respiratory mechanics, vascular flow and mechanoreceptive input (Bordoni & Zanier, 2013). Ongoing sympathetic activation may therefore perpetuate muscular bracing and protective movement, potentially contributing to somatic dysfunction over time (Korr, 1976).

Fascia, Biotensegrity and Postural Adaptation

Fascia is a dynamic connective tissue network that surrounds, supports and integrates all structures within the body, playing an important role in force transmission, proprioception, sensory communication and coordinated movement (Schleip et al., 2012). Highly innervated and vascularised, fascia is key in contributing to proprioception, mechanosensory communication and coordinated movements. When healthy, fascia is hydrated, elastic and able to glide smoothly between body tissues, allowing for even force distribution. If ongoing stress or pain is present, fascial tissue can become restricted, altering tissue tension, reinforcing chronic muscular guarding and perpetuating dysfunctional posture and movement strategies (Schleip et al., 2012).

The biotensegrity concept provides further insight into how forces are distributed throughout the whole body through continuous tensile and compressive relationships, rather than functioning as isolated mechanical components (Levin, 2022). This supports the principle that dysfunction or compensation in one area of the body will affect other areas and influence posture and movement across the organism as a whole.

Within equine biomechanics, myofascial kinetic lines connect muscles, tendons and connective tissues into continuous functional chains (Elbrønd & Schultz, 2015). Two lines are particularly relevant to this discussion. The Superficial Dorsal Line (SDL) is associated with spinal extension, propulsion and defensive bracing. The Deep Ventral Line (DVL) incorporates core stability, diaphragm function and postural support. Horses in a state of chronic sympathetic activation may demonstrate increased SDL tension and a rigid, extended posture (Fazio et al., 2013; Elbrønd & Schultz, 2015), whereas horses displaying shutdown or withdrawal coping strategies (Fureix et al., 2012), may present with reduced thoracic mobility, a restricted diaphragm and poor ventral chain engagement (Bordoni & Zanier, 2013; Elbrønd & Schultz, 2015). Posture, therefore represents a clinically meaningful link between behavioural coping styles and somatic dysfunction.

The Parelli Horsenality Framework as an Observational Lens

Historically, equine behaviour was categorised by ancestry-based temperament classifications. The Parelli Horsenality framework, developed through natural horsemanship practice, offers a more nuanced observational model that combines classical behavioural traits with an understanding of the horse's nature as a prey animal (Parelli & Parelli, 2011). Horses are categorised across two axes: Brain Dominance (Left vs. Right) and Energy Expression (Introvert vs. Extrovert), producing four behavioural types: Left Brain Introvert (LBI), Left Brain Extrovert (LBE), Right Brain Introvert (RBI) and Right Brain Extrovert (RBE).

The introvert-extrovert axis relates to the outward expression of behavioural energy, while the left-right distinction relates to confidence-based versus fear-based behavioural tendencies. It is important to note that this framework lacks formal scientific validation as a diagnostic tool (Kirchhoff, 2018). Studies demonstrate that individual horses respond uniquely to different stressors depending on environment, temperature and autonomic reactivity (Visser et al., 2003). Furthermore, because individual temperaments influence how a horse inherently masks or displays pain, behavioural expression is not fixed but encompasses how horses perceive stress, discomfort and environmental challenges over time (Ijichi et al., 2014).

This thesis does not propose that horses are fixed to specific personality types, nor that behavioural expression can be simply categorised. Rather, the framework provides a conceptual lens through which recurring behavioural tendencies can be explored osteopathically, examining whether observable behavioural patterns correlate with recurring patterns of autonomic regulation, postural organisation and somatic adaptation.

Osteopathic Interpretation of Behavioural Coping Styles

The following model proposes that the Horsenality framework's two axes map onto distinct autonomic regulatory dimensions: the introvert-extrovert axis reflects the level of somatic activation, from conservation-based adaptation at the introvert end to sympathetic mobilisation at the extrovert end; the left-right brain axis reflects the degree of regulatory organisation, with right-brain types demonstrating fear-mediated dysregulation and left-brain types demonstrating more confidence-based, organised responses. Together these axes produce four distinct autonomic-somatic states, each with predictable postural and myofascial correlates, as illustrated below.

Proposed Model: Behaviour coping styles as proxies for autonomic regulatory patterns

Sympathetic activation

Right Brain Extrovert (RBE)
Hyperreactive - Flight orientated

Autonomic Pattern: Chronic sympathetic dominance

Somatic Findings: Increased SDL tension - Extensor dominance
High neck carriage - Hollowed back
Thoracolumbar rigidity

Key Structure: Lumbosacral junction - Epaxial musculature

Myofascial Chain: Superficial Dorsal Line dominant
(Elbrønd & Schultz, 2015)

Left Brain Extrovert (LBE)
Confident - Assertive - Active Coping

Autonomic Pattern: Sympathetic mobilisation

Somatic Findings: Cervical tension - Poll/TMJ restriction
Thoracic inlet restriction
Poor stabilisation patterns

Key Structure: Cervicothoracic junction - Rib cage

Myofascial Chain: SDL + cervical fascial chain
(Elbrønd & Schultz, 2015)

Fear-based dysregulation (Right brain)

Confidence-based regulation (Left brain)

Right Brain Introvert (RBI)
Sensitive - Cautious - Withdrawn

Autonomic Pattern: Dorsal vagal shutdown/freeze (Porges, 2011)

Somatic Findings: Flexion posture - DVL tension
Reduced thoracic expansion
Spinal facilitation (Korr, 1976)

Key Structure: Diaphragm - Pectoral chain

Myofascial Chain: Deep ventral line dominant
(Elbrønd & Schultz, 2015)

Left Brain Introvert (LBI)
Calm - Patient - Conservation Based

Autonomic Pattern: Conservation adaptation

Somatic Findings: Forelimb loading - Heavy forehand
Reduced thoracic sling activation
Diminished spinal oscillation

Key Structure: Diaphragmatic crura - Thoracic sling

Myofascial Chain: DVL - Ventral stabilising system
(Elbrønd & Schultz, 2015)

Parasympathetic / Dorsal vagal

Shared osteopathic targets: Diaphragm, thoracolumbar junction, thoracic sling, sacroiliac region
Treatment goal: Restore movement variability and autonomic adaptability

Fear-based + High energy = Acute sympathetic (RBE)
Fear-based + Low energy = Dorsal vagal shutdown (RBI)
Confidence-based + High energy = Regulated mobilisation (LBE)
Confidence-based + Low energy = Conservation adaptation (LBI)

Profiles are fluid - Horses may shift between quadrants with environment, pain and training.

Note. The two-axis model is informed by the following sources. The introvert-extrovert axis as a proxy for somatic activation level is synthesised from Fazio et al. (2013), Fureix et al. (2012), Porges (2011) and Stucke et al. (2015). The right-left brain axis as a proxy for regulatory organisation and fear-based versus confidence-based responding is informed by Ijichi et al. (2014), Kirchhoff (2018), and Visser et al. (2003). Autonomic and respiratory correlates are drawn from Bordoni and Zanier (2013) and Porges (2011). Myofascial chain associations (SDL and DVL) are based on Elbrønd and Schultz (2015). Somatic and postural findings are informed by Budras et al. (2012), Denoix (2014), Hodges and Tucker (2011), and König and Liebich (2020). Profiles are presented as theoretical propositions and are not intended as diagnostic classifications.

Using the Parelli Horsenality framework as a behavioural observation model, this section explores potential relationships between behavioural coping patterns and osteopathic findings. These discussions are theoretical and are not intended to imply that behavioural classifications directly cause dysfunction. Rather, they examine how repeated behavioural responses and autonomic states may gradually influence posture, movement organisation and biomechanical adaptation over time.

The Left Brain Introvert Profile

The Left Brain Introvert (LBI) horse is often described as calm, patient and food-motivated; however, reduced behavioural expression does not necessarily indicate optimal physiological regulation (Fureix et al., 2012). From a biomechanical perspective, the LBI horse may adopt an energy-conserving movement strategy, reducing impulsion and spinal oscillation (Denoix, 2014). Over time, decreased thoracic lift can limit thoracic sling activation and the ventral stabilising systems, placing greater reliance on passive support structures and increasing forelimb loading (Denoix, 2014). The thoracic sling musculature, particularly the serratus ventralis and pectoral muscles, play a major role in trunk suspension and shock absorption through the forelimbs. Reduced engagement within these structures may contribute to reduced thoracic mobility and shortened stride length (Denoix, 2014). Over time, these reduced locomotion adaptations may become neurologically reinforced, reducing movement variability at a central nervous system level rather than simply reflecting reduced muscular tone (Hodges & Tucker, 2011). Shallow respiratory mechanics and reduced diaphragmatic excursion may develop alongside these postural adaptations, given the diaphragm's close relationship with the lumbar vertebrae via the diaphragmatic crura and its functional connections with the deep ventral stabilising system (König & Liebich, 2020). Rather than presenting with obvious muscular tension, these horses may appear heavy on the forehand and lacking postural adaptability (Denoix, 2014).

The Left Brain Extrovert Profile

The Left-Brain Extrovert (LBE) horse is commonly recognised as confident, assertive and interactive, often displaying active coping styles under stress through continuous movement and engagement with their environment (Parelli & Parelli, 2011). From a neurophysiological perspective, this may reflect sympathetic activation expressed through activity rather than withdrawal (König von Borstel et al., 2017). Persistent locomotion can limit opportunities for efficient stabilisation and organised postural control (Hodges & Tucker, 2011). Over time, repeated recruitment of extensor and locomotor systems may contribute to increased muscular tone throughout the cervical musculature and dorsal fascial chains. Muscles including the brachiocephalicus, trapezius, splenius and omotransversarius are heavily involved in cervical extension and environmental scanning, and chronic overactivation may alter force distribution throughout the axial skeleton (Budras et al., 2012). Increased tension around the thoracic inlet and cervicothoracic junction can affect rib cage mobility and respiratory mechanics (Bordoni & Zanier, 2013). Chronic overactivation within these cervical and thoracic structures may further propagate tension throughout the Superficial Dorsal Line and associated cervical fascial chains, influencing force transmission along the dorsal aspect of the axial skeleton (Elbrønd & Schultz, 2015). Osteopathically, the LBE horse may present as highly mobile but poorly stabilised, with movement patterns reflecting excessive activity and inconsistent biomechanical organisation (Denoix, 2014).

The Right Brain Introvert Profile

The Right Brain Introvert (RBI) horse is commonly associated with sensitive, cautious and inward-processing behavioural presentations (Parelli & Parelli, 2011). Although these horses may appear quiet or compliant, they may demonstrate physiological and behavioural indicators of stress consistent with heightened stress reactivity and hypervigilance (Fureix et al., 2012), consistent with dorsal vagal shutdown responses described within Polyvagal Theory (Porges, 2011). Research has identified behavioural withdrawal and depression-like postures in chronically stressed horses, demonstrating that immobility does not necessarily reflect physiological relaxation (Fureix et al., 2012). From a biomechanical perspective, the RBI horse may adopt protective immobility, gradually reducing thoracic expansion, spinal oscillation and respiratory adaptability (Bordoni & Zanier, 2013). Reduced diaphragmatic excursion may contribute to thoracic rigidity and restricted rib cage mobility (Bordoni & Zanier, 2013). Osteopathically, these horses may demonstrate reduced thoracic sling elasticity, a collapsed posture and increased tension throughout the ventral cervical musculature, pectoral systems and the Deep Ventral Fascial Line (Elbrønd & Schultz, 2015). Through Korr's facilitated segment theory, persistent autonomic stress and repeated protective patterns may contribute to altered neuromuscular regulation and spinal facilitation (Korr, 1976).

The Right Brain Extrovert Profile

The Right Brain Extrovert (RBE) horse is generally characterised by heightened environmental sensitivity, highly expressive behaviour and survival-driven locomotor activation (Parelli & Parelli, 2011). From a neurophysiological perspective, this presentation may correlate strongly with chronic sympathetic nervous system activation and persistent locomotor readiness (Fazio et al., 2013; König von Borstel et al., 2017). Unlike the withdrawal-based postural patterns of the RBI horse, the RBE horse may adopt extension-dominant postures designed to facilitate speed, environmental scanning and rapid directional change (Denoix, 2014). Osteopathically, these horses may demonstrate increased activation throughout the epaxial musculature, particularly the longissimus dorsi, spinalis and iliocostalis systems (Budras et al., 2012). Chronic extensor dominance may contribute to thoracolumbar rigidity, reduced spinal dissociation and restricted movement through the lumbosacral junction (König & Liebich, 2020). Increased tension throughout the Superficial Dorsal Line may further alter force transmission between the axial skeleton and hindquarters, potentially influencing sacroiliac loading and hindlimb propulsion (Elbrønd & Schultz, 2015). Respiratory mechanics may also become compromised, resulting in shallow breathing, reduced diaphragmatic excursion and decreased rib cage mobility (Bordoni & Zanier, 2013). Through Korr's facilitated segment theory, the persistence of these chronic extensor and sympathetic activation patterns may contribute to spinal facilitation and altered neuromuscular regulation throughout the thoracolumbar and lumbosacral regions (Korr, 1976).

Although these coping styles have been discussed separately, horses may transition between patterns depending on environment, stress exposure, training and pain. Behaviour should therefore be viewed dynamically rather than as a fixed classification (McGreevy et al., 2018).

Role of Osteopathy in Supporting Regulation and Adaptability

The goal of osteopathic treatment within this context is to support the horse's ability to adapt efficiently to internal and external stressors, not to alter behavioural expression or personality. Osteopathy aims to improve physiological and biomechanical regulation by restoring mobility, reducing compensatory strain and enhancing adaptive capacity (Chila, 2011). Behavioural expression should not be interpreted as disobedience or temperament alone, but may instead provide valuable information regarding the horse's adaptive capacity, stress physiology and overall functional state.

One primary osteopathic goal is restoring movement variability and balanced force transmission throughout the body. When the horse becomes reliant on repetitive protective strategies, such as; chronic bracing, withdrawal or excessive locomotor activation, movement quality may become less adaptable and more mechanically organised around survival. Through improving joint mobility, soft tissue elasticity and fascial glide, osteopathic treatment may help reduce chronic muscular guarding and restore more dynamic postural organisation (Chila, 2011; Findley, 2009).

The diaphragm may be particularly significant in this process due to its role in respiration, postural stabilisation and autonomic regulation. Restrictions affecting diaphragmatic excursion may influence thoracic mobility, rib cage expansion and thoracolumbar mechanics (Bordoni & Zanier, 2013). Similarly, restoring mobility through the thoracic sling, thoracolumbar junction, cervical region and sacroiliac area may improve spinal oscillation, impulsion and shock absorption (Denoix, 2014). Improving proprioceptive input may also be clinically relevant; fascia is highly innervated and plays an important role in sensory feedback throughout the body (Schleip et al., 2012), and osteopathic treatment may therefore support more efficient neuromuscular coordination.

Clinically, this thesis proposes that behavioural observation should be integrated into osteopathic assessment rather than considered separately. Observing posture, breathing patterns, movement expression and environmental interaction before palpation may provide valuable information regarding autonomic state and adaptive strategies (Porges, 2011). Supporting physiological regulation and movement adaptability may also indirectly support behavioural adaptability and stress resilience over time.

Discussion

This thesis proposed a theoretical framework exploring how behavioural coping styles may relate to autonomic regulation, postural organisation and somatic dysfunction within the horse. A key strength of this integrative approach is its consideration of movement quality, respiratory adaptability and autonomic state as functional indicators of compensation and adaptation - consistent with the osteopathic understanding that dysfunction is associated with reduced adaptability rather than isolated structural pathology (Chila, 2011).

It is to be noted that references to Polyvagal Theory within this thesis are used as conceptual frameworks for understanding stress-related behavioural states rather than as validated equine neurophysiological models.

A particularly important discussion point concerns the quiet horse. Throughout equine practice, calmness is often interpreted as relaxation or good temperament. However, chronic stress may manifest through behavioural withdrawal and depression-like postures (Fureix et al., 2012), and outward compliance should not automatically be interpreted as evidence of physiological regulation or physical ease.

Several limitations must be acknowledged. The Parelli Horsenality framework is not a scientifically validated classification system, and the osteopathic interpretations throughout this thesis remain theoretical due to limited direct research linking behavioural coping styles with specific somatic dysfunctions in horses. Behaviour is also highly multifactorial, influenced by genetics, training, environment, management, pain and previous experience (McGreevy et al., 2018), and the relationship between behaviour, biomechanics and nervous system regulation is likely bi-directional and continuously adaptive rather than linear. The horse-human dyad must also be considered; horses respond to human emotional state and handling, and chronic stress within the rider or handler may influence the horse's autonomic regulation and movement patterns (Keeling et al., 2009).

Future research integrating heart rate variability (HRV) as a measure of autonomic regulation (von Lewinski et al., 2013), alongside posture analysis and movement variability studies, may provide objective evidence for the associations proposed here. Longitudinal studies combining behavioural science, osteopathic assessment and biomechanical analysis could meaningfully contribute to an evidence-based understanding of how chronic stress and adaptive coping strategies influence equine welfare and somatic adaptation over time.

Conclusion

This thesis explored the potential relationship between behavioural coping strategies, autonomic regulation and somatic dysfunction within the horse, using the Parelli Horsenality framework as an observational model. Through integrating osteopathic philosophy, neurophysiology, fascial research, biomechanics and equine behaviour, the discussion proposed that behavioural expression may provide clinically relevant insight into the horse's adaptive neurophysiological and biomechanical state.

Rather than viewing behaviour solely through temperament, training response or performance, persistent autonomic nervous system activation may influence postural organisation, movement variability and respiratory adaptability. Different behavioural coping strategies may therefore reflect distinct biomechanical adaptations designed to maximise survival under perceived stress. Structures such as the diaphragm, thoracolumbar junction, thoracic sling and fascial continuities emerged as particularly significant due to their relationships with respiration, stabilisation, force transmission and autonomic regulation (Bordoni & Zanier, 2013; Denoix, 2014).

Importantly, this discussion does not suggest that behavioural classifications directly cause dysfunction, nor that all behavioural expression reflects pathology. Behaviour is dynamic, multifactorial and context-dependent (McGreevy et al., 2018). However, recognising behavioural coping styles as possible reflections of adaptive neurophysiological and biomechanical states may assist osteopathic observation and contribute toward a more holistic understanding of equine welfare, performance and stress adaptation. The conceptual framework presented — integrating Horsenality-based observation with osteopathic clinical reasoning — may serve as a foundation for future empirical investigation within the field of equine animal osteopathy.

References

American Osteopathic Association. (2010). *Glossary of osteopathic terminology* (2nd ed.).

Bordoni, B., & Zanier, E. (2013). Anatomic connections of the diaphragm: Influence of respiration on the body system. *Journal of Multidisciplinary Healthcare*, *6*, 281–291. https://doi.org/10.2147/JMDH.S45443

Budras, K. D., Sack, W. O., & Röck, S. (2012). *Anatomy of the horse* (6th ed.). Schlütersche.

Chila, A. G. (Ed.). (2011). *Foundations of osteopathic medicine* (3rd ed.). Lippincott Williams & Wilkins.

Denoix, J.-M. (2014). *Biomechanics and physical training of the horse* (1st ed.). CRC Press.

Dyson, S., Berger, J., Ellis, A. D., & Mullard, J. (2018). Development of an ethogram for a pain scoring system in ridden horses and its application to determine the presence of musculoskeletal pain. *Journal of Veterinary Behavior*, *23*, 47–57. https://doi.org/10.1016/j.jveb.2017.10.008

Elbrønd, V. S., & Schultz, R. M. (2015). Myofascia — the unexplored tissue: Myofascial kinetic lines in horses, a model for describing locomotion using comparative dissection studies derived from human lines. *Medical Research Archives*, *3*. https://esmed.org/MRA/mra/article/view/125

Fazio, E., Medica, P., Cravana, C., & Ferlazzo, A. (2013). Hypothalamic-pituitary-adrenal axis responses of horses to therapeutic riding program: Effects of different riders. *Physiology & Behavior*, *118*, 138–143. https://doi.org/10.1016/j.physbeh.2013.05.009

Findley, T. W. (2009). Fascia research II: Second international fascia research congress. *International Journal of Therapeutic Massage & Bodywork*, *2*(3), 4–9. https://doi.org/10.3822/ijtmb.v2i3.61

Fureix, C., Jego, P., Henry, S., Lansade, L., & Hausberger, M. (2012). Towards an ethological animal model of depression? A study on horses. *PLoS ONE*, *7*(6), e39280. https://doi.org/10.1371/journal.pone.0039280

Hodges, P. W., & Tucker, K. (2011). Moving differently in pain: A new theory to explain the adaptation to pain. *Pain*, *152*(3 Suppl), S90–S98. https://doi.org/10.1016/j.pain.2010.10.020\

Ijichi, C., Collins, L. M., & Elwood, R. W. (2014). Pain expression is linked to personality in horses. *Applied Animal Behaviour Science*, *152*, 38–43. https://doi.org/10.1016/j.applanim.2013.12.007

Keeling, L. J., Jonare, L., & Lanneborn, L. (2009). Investigating horse–human interactions: The effect of a nervous human. *The Veterinary Journal*, *181*(1), 70–71. https://doi.org/10.1016/j.tvjl.2009.03.013

Kirchhoff, R. (2018). *Comparison of equine behavior to Parelli Horsenality* (Publication No.

77) [Honors thesis, East Texas A&M University]. The LAIR at East Texas A&M. https://lair.etamu.edu/honorstheses/77/

König, H. E., & Liebich, H. G. (2020). *Veterinary anatomy of domestic mammals: Textbook and colour atlas* (7th ed.). Thieme.

König von Borstel, U., Visser, E. K., & Hall, C. (2017). Indicators of stress in equitation. *Applied Animal Behaviour Science*, *190*, 43–56. https://doi.org/10.1016/j.applanim.2017.02.018

Korr, I. M. (1976). Spinal cord as organizer of disease processes: Some preliminary perspectives. *Journal of the American Osteopathic Association*, *76*(1), 35–45.

Ladewig, J. (2019). Body language: Its importance for communication with horses. *Journal of Veterinary Behavior*, *29*, 108–110. https://doi.org/10.1016/j.jveb.2018.06.042

Lencioni, G. C., de Sousa, R. V., de Souza Sardinha, E. J., Corrêa, R. R., & Zanella, A. J. (2021). Pain assessment in horses using automatic facial expression recognition through deep learning-based modeling. *PLoS ONE*, *16*(10), e0258672. https://doi.org/10.1371/journal.pone.0258672

Levin, S. M. (2022). Biotensegrity: The mechanics of fascia. In R. Schleip, J. Wilks, & C. Huang (Eds.), *Fascia in sport and movement* (2nd ed., pp. 15–23). Handspring Publishing.

Matthews, P. B. C. (1964). Muscle spindles and their motor control. *Physiological Reviews*, *44*(2), 219–288. https://doi.org/10.1152/physrev.1964.44.2.219

McGreevy, P., Christensen, J. W., König von Borstel, U., & McLean, A. (2018). *Equitation science* (2nd ed.). Wiley-Blackwell.

Parelli, P., & Parelli, L. (2011). *Parelli Horsenality: Understanding your horse's unique personality*. Parelli Natural Horsemanship.

Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation*. W. W. Norton & Company.

Stucke, D., Große Ruse, M., & Lebelt, D. (2015). Measuring heart rate variability in horses to investigate the autonomic nervous system activity: Pros and cons of different methods. *Applied Animal Behaviour Science*, *166*, 1–10. https://doi.org/10.1016/j.applanim.2015.02.007

Schleip, R., Findley, T. W., Chaitow, L., & Huijing, P. A. (Eds.). (2012). *Fascia: The tensional network of the human body*. Elsevier Churchill Livingstone.

Seffinger, M. A., King, H. H., Ward, R. C., Jones, J. M., Rogers, F. J., & Patterson, M. M. (2003). Osteopathic philosophy. In R. C. Ward (Ed.), *Foundations of osteopathic medicine* (2nd ed., pp. 3–18). Lippincott Williams & Wilkins.

Still, A. T. (1899). *Philosophy of osteopathy*. Hudson-Kimberly Publishing Co.

Taylor, P. M., Pascoe, P. J., & Mama, K. R. (2002). *Diagnosing and treating pain in the horse: Where are we today? Veterinary Clinics of North America: Equine Practice, 18*(1), 1–19. https://doi.org/10.1016/S0749-0739(02)00009-3

Visser, E. K., van Reenen, C. G., Rundgren, M., Zetterqvist, M., Morgan, K., & Blokhuis, H. J. (2003). Responses of horses in behavioural tests correlate with temperament assessed by riders. *Equine Veterinary Journal*, *35*(2), 176–183. https://doi.org/10.2746/042516403776114108

von Lewinski, M., Biau, S., Erber, R., Ille, N., Aurich, J., Faure, J. M., Möstl, E., & Aurich, C. (2013). Cortisol release, heart rate and heart rate variability in the horse and its rider: Different responses to training and performance. *The Veterinary Journal*, *197*(2), 229–232. https://doi.org/10.1016/j.tvjl.2012.12.025