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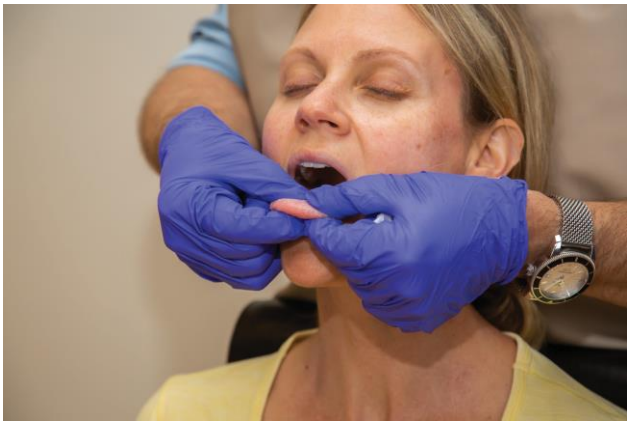


Building a model

Having devoted so much time questioning what is taught and practiced, it is time to put forward that model. However, instead of a single narrow model, a range of views is presented, as there is not one broadly accepted view on how MT facilitates change. Uncertainties, such as having more than one possible explanation, are uncomfortable feelings for many, but I have grown to view them as a sign of acceptance of reality. Like many, the more I have learned, the less I am sure. Decades ago, I spoke with certainty about how and why problems and pain occur, although, in hindsight, my explanations were relatively narrow and essentially wrong. Today, I strive to be less wrong, as no one can be entirely right about this. A wide range of plausible concepts relates to touch and interactional effects to why our MT interventions are helpful.

Uncertainty need not mean we do not have strong preferences for specific ideas, but allowing for uncertainty allows space for the multiplicity of seemingly overlapping and distinct narratives. Uncertainty requires an allowance for conflicting views. Rigidly ascribing to only one view lessens the chance for growth. My dogmatic adherence to earlier explanations stunted my early growth in the manual therapy field. I now allow the fascia to have a place, but its place is one of balance, equitably embedded in the vastness of the human condition. Given the current understanding of the role of patient preferences and

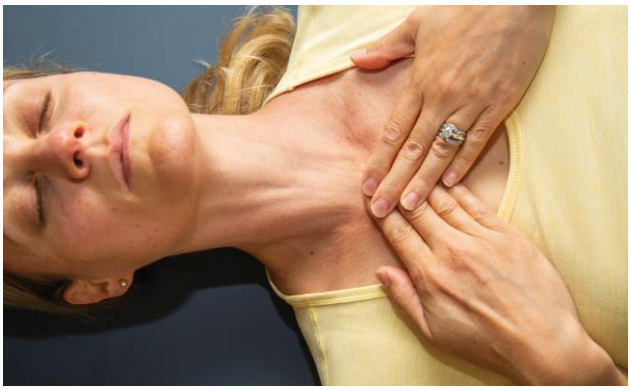
values, I also find it necessary to allow my patients' views to carry weight. While I may not feel that their explanation is accurate, given what I do not yet know and not being involved in their lived experiences, I should never deny or negate their perspectives.

The content in this section may be a bit heavy for some and light for others. For those who seek more depth, copious references are provided for you to dig deeper at the end of this and other chapters. For those who wish to get to the hands-on work, please stick with me, as it will follow shortly. However, a deeper understanding of the mechanisms of action for that hands-on work is needed. What is it that we are trying to do or trying to influence?

Practical experience

To place the uncertainty of these narratives into proper perspective, I would like you to try a bit more experimentation in "self-treatment." I will ask you to locate the sternal notch, also known as the jugular notch or suprasternal notch, which is the space just above the top of the breastbone.

Position yourself in a comfortable chair or lie down. Place the fingertips of fingers 2–4 of one hand just above the very top of the sternum. Your grip may be improved if you expose the skin of the lower neck and upper sternum for this exercise, although working through clothing is always acceptable. The fingertips are your focus at and around the sternal notch. It might be helpful for you to poke about a bit to locate the notch lightly. (Throughout this book, I will be detailing hand locations and how to engage the desired area of the body. Please understand that the exact specificity of hand placement is unnecessary, with few exceptions. While I am coaching you to begin from the deepest part of the sternal notch, you may find more relevance if you wander off course.) Next, place your other hand directly over the top of the first hand.



You will give a very light stretch to this region toward your feet, gently pulling the skin away from the hollow of the sternal notch. How far and aggressively you stretch is up to you; as I previously mentioned, there is little consensus on what intensity of stretch is best.

- Drag the skin downward until you feel a bit of resistance.
- Lightly hold that resistance while slowly lifting your chin and tipping your head backward. You need not tip far to engage the stretch, nor will you be able to move your head and chin too far. In essence, you are tightening the skin and underlying tissues between your downward pulling hands and the tension created by lifting your chin and tipping your head.

- Once you feel tension, simply hold on for a bit, observing what you are feeling.
- While holding the tension, try swallowing.
- Is it difficult to do so?
- Is that feeling familiar in any way?
- Do you feel the skin around the sternal notch rising upward in response to the swallowing attempt?
- If those feelings of swallowing difficulty are familiar to your patient, this may become the beginning of a therapeutic engagement.
- Do you find it difficult to close your mouth while engaging in this stretch?
- Ask yourself why it is more difficult to swallow or close the mouth.
- Is it from tension in the muscles?
- Is it stretching on the skin?
- Restriction along the nerves?
- An alteration in the larynx or hyoid position?
- Hold the stretch for a bit, maybe a minute or two, then ease up on your tension along the sternum and allow your head to return to a resting position.
- Now try swallowing again.
- What do you feel?
- Did your normal swallowing return?
- Does swallowing feel different, either more difficult or less difficult?
- If a change occurred, why did it change?
- Try voicing before, during, and after the stretch. If the voice feels different while stretching, why might that be? If it feels altered from its initial sound or feeling after the completion of the stretch, why might that have taken place?

Your answers to any of the questions posed above may have been influenced by your past experiences, which include your education, training, experience, and influences from others. The experience itself might be included, as our brains are easily influenced by what we feel, where we feel, and how the impact is noted. One person sees changes due to muscle impacts, and another might see lessening neural (nerve) tension. Still, others might see working against resistance as a form of exercise, with changes instituted by increased strength. Is it unreasonable to include tension of the skin itself as a factor in change? If the skin is attached to deeper structures through the network of connective tissue, can skin be seen as the handle with which we reach deeper into the body? If nerves exist and glide within tunnels (they do), and if disruptions in the nerve's ability to glide and slide within those tunnels impact the responsibilities of that nerve, could nerve-tunnel impairments be seen as a potential causative factor in functional disorders? Suppose all nerves reach the surface via smaller cutaneous nerve branches. Might it be possible to reach back into the nervous system by engaging those cutaneous nerves near the surface via skin stretching? Muscles are movers, but what signals a muscle to move or potentially limits that action? Nerves carry the signals to and from the muscle (and all other structures), so can we blame muscles alone for high tension that impairs voice in muscle tension dysphonia or any disorder, including radiation fibrotic changes?

I exist in a world filled with competing claims, primarily given by clinicians and educators who make claims about singular tissue/pathology problems and solutions. I will often counter those claims or, at a minimum, place some doubt into the claim by stating, "if the person felt your touch when you interacted with them, then doubt is immediately cast on claims of single tissue selection (muscle, trigger point, fascial restriction, muscle tension, etc.). The central and autonomic systems (CNS and ANS) are immediately activated if they feel the touch. Can movement, performance, and pain change through a CNS-only effect? We see it in cognitive/behavioral, and pedagogy approaches, so why is MT different? Can a sense of threat (or safety) change pain or function? Yes. If touch is perceived, those ANS reactions can be a part of the overall outcome.

Therapeutic encounters of all types rely on the patient's brain-based and cognitive changes. Is MT so different? Our brain is fully capable of both limiting function as well as improving function. Why might we be able to accept influences on muscles at the periphery as a complete therapeutic explanation while minimizing or excluding the possibility of the central nervous system and brain-based contributions

as primary contributors? Autonomic state (fight/flight, rest/relaxation) can influence functional capacities (vocal changes or globus presence/severity when stressed), so might aiding autonomic management play a role in therapeutic outcomes? Must each of these potential influencers act singularly, or are they concurrent factors influencing change in function?

How can we know whether one model is entirely correct or incorrect? I do not believe it is possible, so I allow uncertainty to be an aspect of this work. Some see uncertainty as a lack of understanding or education or even a lack of self-assurance. However, the acceptance of uncertainty may represent an acknowledgment of deeper understanding. Simplistic single-source explanations are seductively appealing but likely inadequate.

Your responses to the questions asked during the above hands-on exercises may be completely accurate, or at least part of a fuller accurate answer. Some explanations make no logical sense to me, nor do they seem to align with current understandings of the human body. However, as I often repeat, I have not lived your life and therefore find it hard to judge your responses. Nor should anyone. However, the multiple and often overlapping explanations for how MT impacts problems (allowing for the uncertainty that more than one explanation could be at play) benefit a more inclusive means of understanding the complexities of disorders.

Does anatomy matter?

When reflecting on voice, swallowing, oral motor problems, and breathing-related issues, does fibrotic tissue, excessively high muscle tension, scar tissue, fascial restrictions, poor posture, muscle weakness/tightness, improper breathing patterns, or tongue tightness/weakness matter? Does anatomy matter?

To imply that anatomy is not meaningful is foolish, as our anatomy, coupled with physiology, cognitive control, and the many other aspects of being human, all play crucial roles in all aspects of life. When I ask clinicians at my seminars if anatomy matters, all agree that it does. However, regarding the dysfunction, pain, and other deficits they work with, there is, at times, marked disagreement when I ask them if one aspect of anatomy matters more than others. Even for those with little experience utilizing manual therapy, the inherited explanations of voice, swallowing, breathing, and postural disorders are often backed by tissue or pathology-based beliefs. To the vocal coach, a well-aligned body might be necessary for optimal vocal production. Their views of anatomical (and physiological) importance may elevate certain aspects of anatomy to higher levels than others. To those using laryngeal manipulation to remediate vocal problems, possessing intimate awareness of the origins and insertions of the muscles involved with voice is paramount, as well as the optimal orientation of the larynx, as without such an anatomical understanding, their work is meaningless. Each views anatomy from the perspective of their beliefs.

Anatomy does not exist in isolation, in a vacuum, but rather blended into the whole system's complexities. When we move beyond idolatry of single tissues, pathologies, or systems of greater importance than others, I believe we will see the utility of a blended explanation for how MT acts as an impetus for change. When we can open the lens beyond the specificities of our training and belief to see that voice, swallowing, breathing, and oral motor function all occur through complex processes controlled from above (brain and CNS), impacted by outside influences (ANS), and tasked to work through local action (muscles), we then stand a better chance of treating the whole person.

On a recent thread in a social media group, a question was posed: does anatomy matter when it comes to MT? As is the norm on social media, there was no consensus, although few supported my position statement from the paragraph above. Most viewed that outcomes would suffer without an in-depth understanding of anatomy, although precisely what anatomical understanding mattered most varied considerably.

Until recently, my opinion was that anatomy mattered much less than many believe, but some comments on that post made me rethink my position.

The actual tissues involved in anatomy may not matter more than, or as much as, the therapeutic relationship, but the *perception* of anatomical mastery by us to the patient may matter greatly. Patient perspectives and values influence outcomes, so the perception that I am knowledgeable about anatomy (and physiology) may sway patient trust in our abilities. To avoid public perceptions of poor knowledge, potentially limiting trust in us, I believe the key is to show that we know what we are doing but that we are astute enough to know that uncertainty exists. For example, if a new patient asks me what tissue (what muscle) or pathology (such as trigger points or high muscle tension) is responsible for their problem, if I reply, "I do not know" and give no follow-up, they will likely flee my office, seeking a more knowledgeable clinician. However, in response to that same question, I reply, "I am not completely certain. It might be the fibrotic changes that are primarily responsible, or it could also be neurological patterning and perceptions that the procedures have impacted. While some clinicians may state with certainty the cause, there are so many views, making certainty impossible." The second response allows uncertainty to prevail without making me sound like I'm ill-informed. There is an art to presenting the larger picture that takes some practice, but we will get to that later. For now, think about responding to such questions in a way that allows your patient (and yourself) to see the subtleties of a problem by looking at it from various perspectives.

A multifactorial model

What follows applies to all aspects of MT, not just intervention with voice and swallowing. At times mention will be isolated to a specific disorder, but the principles and theory apply across the spectrum of disorders presented through this book and beyond. What goes into a multifactorial model to explain the effects of manual therapy for voice and swallowing disorders? How are choices made for what should be included while others are excluded? Over the past decade, I have devoured countless articles surrounding this topic, with a decision for inclusionary criteria to be defined as those narrowed to "credible" narratives. However, what makes one model or view credible and another not? In Chapter 3, I mentioned research from the perspective of Chinese Medicine. In many contemporary medical journals, Chinese Medicine is viewed as less credible, but from the perspective of our patients, those perspectives may hold value and meaning. I have already stated my bias away from single source pathology models, but those models are exceedingly influential for many clinicians and patients, at least from a believability perspective. I have also been blunt about my past experiences in the myofascial release (MFR) model and my inherent biases from that experience. In the multifactorial model about to be presented, I will allow a more liberal inclusion of the available resources, with some mentioned in more depth than others. I believe it nearly impossible to include every possible perspective, but with that clearly stated, I will attempt to mention a cross-section of available evidence.

The model I am proposing is an outline of what I hope to fill in over time and for it to inspire researchers in the voice and swallowing fields to use as a springboard to refine the niche historical perspectives that they are currently using. The model will examine the biological factors of the physical MT interaction, and rather than including them as secondary considerations, including psychosocial factors that are integral components of the MT interaction itself as primary factors. Unlike the supposed linear cause and effect relationships implied in the previously mentioned papers, exact pathways cannot be described when the full range of possibilities is explored. MT influences and effects exist along a continuum, with factors varying from person to person and from session to session within the same person. Another variable is the clinician, as views of the clinician as a neutral observer are simply inaccurate. When we initiate a therapeutic relationship, we are an inseparable part of that interaction. In the following chapter, we will touch on the psychosocial and behavioral aspects of the therapeutic relationship.

The historical narrative of MT's effects as peripherally based has undergone significant re-examination

over the past 15–20 years. However, there continues publication of studies written from those older historical perspectives of tissue or pathology-based viewpoints. Such views and assumptions confuse and hinder the evolutionary process of understanding the multifactorial impacts and, in turn, the complexities of the human condition. Having first-hand experience in the field of MT *modalities*, the publication of modality-based models of MT does not seem to require a vigorous vetting of a claimed mechanism of action, if any, for the tissue or pathology-based model on which they are reporting. Without minimizing the efforts of the research posted here and elsewhere, so long as one can reach back into a previously published paper for an explanation of a mechanism of action, the paper appears to meet the requirements for all but the most stringent peer-reviewed journals. As an example, Marszałek *et al.* (2012) utilizes what appears to be a closely followed blend of Aronson's (1990) and Lieberman's (Rubin and Lieberman, 2000; Lieberman *et al*., 2005) techniques and protocols but insert mention of fascia (connective tissue) and myofascial techniques. In that paper, there was no description or discussion as to how such fascia-inclusionary approaches or techniques differ from muscle-specific techniques used by others or any specific references as to why the MSK views were expanded from muscle-based to myofascial- (muscle + connective tissue)based. One might argue that such variations in descriptions were superficial semantic differences, using different conceptual language to relate similar experiences. However, when viewed from a critical lens, such omissions are common in tissue or pathology-based literature and serve only to confuse rather than educate.

Before moving into a literature review, a few terms must be better defined. When using the term *pathology-based,* reference is being made to pathologies that have been implicated in pain, movement disorders, and some of the problems associated with muscle tension dysphonia (MTD). Such pathology-based factors might include trigger points (Asher, 2013), as trigger points are considered a pathology. Another example might be laryngeal elevation as an evaluative determinant of dysfunctional voice. *Tissue-based* impacts might include the direct and local reduction in muscle tension (Aronson, 1990), with muscle being the tissue in question or restrictions within the fascia (Marszałek *et al*., 2012). These pathology and tissue-based concepts surrounding the injury and its therapeutic remediation formed the basis of how MT was taught to me at university in the 1980s and through my physical therapy career via continuing education. However, through knowledge-based evolution, we can see that the narrower beliefs have been supplanted by views that "clinicians should remember that manual techniques are not tools to fix the patient's body, rather they provide the opportunity to communicate with the patient's brain similar to words" (Geri *et al*., 2019, p.3).

Despite manual therapy's role in healthcare for centuries (Bizzarri *et al*., 2019, p.2), a deeper understanding of its mechanism of action remains elusive for many in the MT field, including the voice field. Reasons for such a delay are many, including a clinician's reluctance to modify what has given success or satisfaction from the tissue-based mechanism taught to them, to a lack of motivating factors even to begin questioning historical narratives on the part of researchers in the voice field. Having success forms a strong wall against change. Specific authors have highlighted the need for an update. Bialosky states this biological mechanism of action is one of two pre-requisites that must be met before mechanistic-based approaches can be accepted, with the other pre-requisite being the identification of "a mechanism contributing to a clinical population or subpopulation (i.e., a homogeneous subgroup)" (Bialosky *et al*., 2018, p.1). One might successfully argue that this second pre-requisite has been met in cases of MTD as it is a well-defined subgroup. However, the biological mechanism of action of the intervention has not yet been fully formulated. "Mechanistic-based treatment approaches for MT necessitate identification of the key mechanisms through which MT works; however, the current understanding of these mechanisms is lacking, requiring additional and more optimally designed studies to answer this important question"

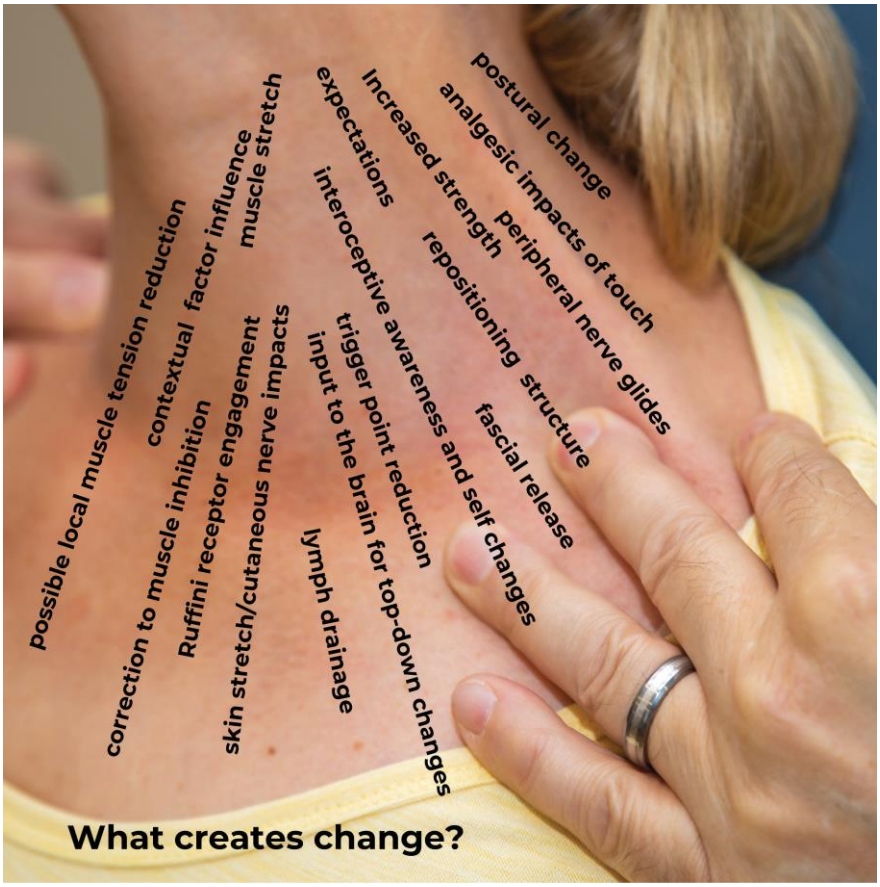


Figure 5.1 Possible ways manual therapy may create an impact

(Bialosky *et al.*, 2018, p.1). From these viewpoints, the possibilities will be explored.

Neurocentric to behavioral perspectives

To many, neurocentric explanations may not present a more plausible mechanism of action than those provided by traditional MSK or local tissue models. They are minimally discussed in past and current literature when MT concerns the remediation of voice dysfunction. They are presented as additions to what will become a crowded field of potential influencers. However, when one looks at the anatomical framework in which peripheral tissues are monitored (sensory) and influenced (motor), the necessity for neurocentric inclusion becomes more readily apparent, at least as a component of that mechanism. Once the complexities of any MT influencer are explored, the correlation with behavioral impacts will also be better understood.

Neurodynamic technique (NDT) is an evolving model used to explain aspects of typical MSK domain-related problems from a neurocentric narrative. These concepts should not be confused with Neuro Developmental Technique (also NDT), a treatment method for movement and posture for those with lesions of the CNS developed by Berta and Karl Bobath in 1948. Neurodynamics refers to communication between different parts of the nervous system and its relationship to the MSK system (Shacklock, 1995). Nerve function and efficiency depend on many factors, one of which is the nerve's ability to move unimpeded within connective tissue tunnels (Butler, 1989; Butler *et al.*, 2000; Shacklock, 1995). A disruption or restriction in a nerve's ability to glide and slide within its tunnel (tunnel syndrome)

can impact the nerve's ability to transmit sensory and motor information. Imagine the feeling of a too-tight sweater/jumper restricting the arm's ability to move freely as an analogy to what happens to a nerve in a restricted tunnel. Our internal irritation or frustration represents our possible reaction to that tightness, much as alterations in sensation or motor function represents a nerve's possible reaction to an impairment or restriction to its tunnel. As nerves are seen to move independently of other tissues, NDT conceptually is a framework for mobilizing those nerves by using the surrounding tissues to reduce any tunnel restriction. It is believed that injury, trauma, ischemia, and other insults can potentially limit a nerve's freedom of movement within its tunnel. Such limitations may result in pain, sensory and motor disturbances, and other functional issues. Based on work done by Ateras *et al.* (2017); Butler (1989); Butler *et al.* (2000); Nee *et al*. (2006, 2012); Shacklock (1995); and von Piekartz *et al.* (2002), it is possible to not only isolate and test individual nerves for such tunnel syndromes, but it has also been shown that we can selectively bias and treat those tunnel syndromes. Treatment takes on various names, including nerve flossing and gliding. Simplistically, to continue the previous analogy, gliding the arm in and out of the too-tight sleeve (flossing) would slightly stretch the sweater sleeve (in this example), reducing any aberrant tightness hindering movement, allowing more unrestrained movement with less irritation. The realities of how nerve glides impact nerve movement limitations are more complex from even the initial views of the local reduction of tunnel impairments. The curious reader is directed to the resources listed above.

Muscles are movers, sometimes working just as designed and other times seemingly working on overload or not well at all. Injury can impact muscle function, as can overuse or improper use, but is it the muscle alone responsible for these aberrant actions, or might the nervous system also be involved (Bialosky *et al*., 2009, p.4; Nijs *et al*., 2013)? Nerves are the messengers from the brain to the periphery and carry the signals to and from the muscle, so can we, with certainty, blame muscles alone for high tension that impairs voice in MTD? The brain can limit and potentially improve function (Jacobs, 2021, p.4). Be it from surgery, trauma, radiation-induced changes, or overuse, if the nerves that innervate the laryngeal region musculature cannot freely move and express, might that not be a valid perspective for muscle tension through the voice region? NDT is a plausible explanatory perspective on how change is introduced when MT is applied at the periphery (Ateras *et al*., 2019).

While NDT, and the basic premise of the model, may seem abstract concerning specific issues of voice, the tongue, and related areas and problems facing the SLP and related professions, a recent paper brought NDT into the SLP and voice literature via a 2017 paper titled *Integration of a neurodynamic approach into the treatment of dysarthria for patients with idiopathic Parkinson's disease: A pilot study* (Ateras *et al*., 2017). With a brief but thorough description of the principles underpinning NDT, Ateras compared traditional SLP interventions for Parkinsonian dysarthria with the same intervention with NDT added to the nerves of the facial region. While this study is at present an isolated foray into applying NDT in the field and swallowing, more such crossover papers will deepen its application and appreciation. Ateras provides a blueprint for incorporating NDT into future voice literature and a model for broadening proposed mechanisms of action.

While not specific to voice, swallowing, or the related topics presented in this text, Diane Jacobs, PT, has an approach to MT termed DermoNeuroModulating (DNM) and speaks at length about how we interact with other humans via touch. She refers to all types of MT as *social grooming* as a nod to the social behaviors of primates intended not to create change but as a functional interchange. Healthcare providers may bristle at the thought of their interventions being called social grooming. However, interpersonal interactions of any type can fall into this category, and the act of caring, listening, touching, and acting in another's best interests carries the potential for impact. Concepts steeped firmly in neuroanatomy and neurophysiology are implicit in Jacobs' work and

include behavioral constructs, all of which have the potential to impact change (Jacobs, 2021). Such perspectives on the social aspect of MT cross over into the BPS model and SDM model (Bainbridge) in creating a vision for MT to be a partnership between patient and clinicians, where the clinician interacts *with* the patient (physical and socially) rather than acting as the operator over the patient (Jacobs and Silvernail, 2011).

Jacobs approaches manual therapy from the perspective of skin-first and explores how neurological processes from touch at the periphery, emanating from and through the skin, may be sufficient to explain the effects seen with MT. To paraphrase Jacobs, despite claims of impacting muscle, bones, joints, fascia, and more, there is only one thing that we have certainty of touching, of impacting: Skin. Much of what follows is elicited from Jacobs' course syllabus (Jacobs, 2007), her book, *DermoNeuroModulating* (Jacobs, 2016), and a more recently published paper (Jacobs, 2021).

The underlying premise Jacobs puts forth is simple. With sensation noted immediately at any place in the body, and sensations reacted locally and inputted to the brain capable of resulting in a modification at the periphery, mightn't this be sufficient to explain at least some of the changes noted during MT? We touch a hot pan, and our hand withdraws. Stimulus produces change. Touch-based cueing to the chin for postural correction typically results from drawing the chin backward. We accept these and thousands of other such acts as a regular part of human behavior, but proponents of MT often wall off their touch as being more precise. They see it as acting on a specific tissue or pathology. However, mightn't local sensory awareness be, at least in part, sufficient to begin change? In Figure 5.2 (below), note the complexity and widespread distribution of cutaneous nerves. Such complexity exists throughout the body. With this degree of potential awareness, mightn't MT's influences be at least partially attributable to local awareness?

NDT principles teach that proper selection and biasing of an individual peripheral nerve allows the potential for positively impacting the entire distribution of that nerve, from origin to terminus. That stated, as terminal nerve branches eventually reach the skin level via smaller cutaneous nerve branches, might it be possible to reach back into the nervous system (and eventually to the brain) by engaging those cutaneous nerves near the surface via skin stretching? Jacobs strongly implies that most responses to MT, no matter the mechanism of action stated, are, in fact, skin-based NDT effects rather than effects caused by deeper tissue and structure impacts. To those trained in other models, such as muscle-based models, such a concept seems absurd, as logical assumptions lead us to believe that deeper pressure is needed to access deeper tissues and other common assumptions. Nevertheless, what binds all those seemingly overlapping or disparate MT models and modalities?

NDT has evolved as a process that allows us to selectively target specific nerves for evaluation to determine if a problem exists and to apply specific techniques to free that nerve from its limitations and, in turn, restore function. Many larger upper and lower extremity nerves have been mapped with

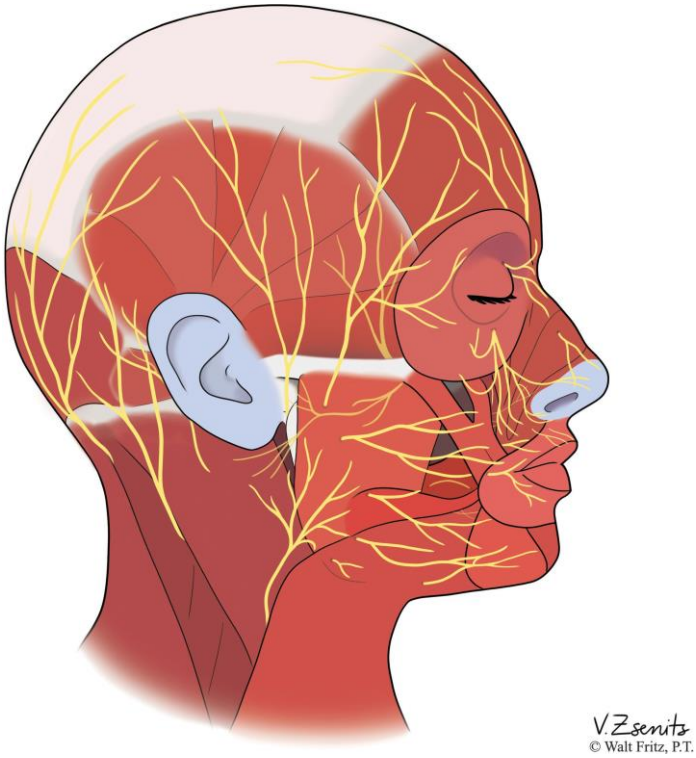


Figure 5.2 An illustration of the complex and widespread distribution of cutaneous nerves.

specific biasing techniques described to place that nerve on its maximum stretch (Butler *et al*., 2000; Shacklock, 1995). That point becomes the beginning of treatment if the evaluation shows a problem. Most of such nerve mapping has been done to larger nerves, although von Piekartz has examined many facial nerves to describe their paths and how to institute testing and treatment (von Piekartz *et al*., 2002). Jacobs describes how transition points, or grommets, as she calls them, where the smaller cutaneous nerves pass through tissue layers, can become common locations of nerve tunnel limitation and subsequent pain/dysfunction (Jacobs, 2016). She has evolved the concept of peripheral nerve entrapment by applying mobilization of the cutaneous nerves to provide input throughout the nervous system. Jacobs' approach is delightfully simple: stop thinking we have direct and unfettered access to anything beneath the skin when skin alone (via the cutaneous nerves that communicate with peripheral and central nerves) has a direct link to the brain. Her 2021 paper, *Skin is the outside of the brain*, speaks to these connections.

While I admire her pluckiness in encouraging a move toward the simpler, such wholesale changes in clinicians' way of thinking may not meet Jacobs' level of suggestion. However, if the clinician is open to exploration of this and other views, my concept of uncertainty may take hold. Multifactorial influences are at play with any clinical or pedagogical interaction, no matter the provider's or receiver's beliefs.

Broadly, I see my manual therapy perspectives resembling Jacob's DNM approach. However, my approach emphasizes patient feedback as a primary driver rather than Jacob's lean toward following known nerve pathways. Ateras *et al*. (2017) follow Jacobs' approach through nerve-based models, but the slow, static engagement of the skin bears striking similarities to my approach. NDT and DNM are variations in biological tissue-based perspectives and may represent shifts toward greater plausibility over many other tissue-based models based on the level of evidence supplied. The bias expressed here is apparent. The interweaving is evident throughout the various models, both old and new.

Poor posture is frequently viewed as a problem of muscle weakness, soft tissue tightness, poor/fault habits, and a result of modern technology. All may have credibility but think for a moment at the body's reaction to nerve entrapment. Suppose somewhere along the path of a nerve, its movement has been limited, unable to move within its sheath (tunnel) fully. In that case, the probability exists that sensory or motor disturbances will result. Our brain tries to avoid such disturbances and accommodates accordingly, with resultant changes in stance, holding patterns, and movement. I see it as acceptable to add nerve tunnel syndromes to the possible contributors to postural changes. If it hurts to erect the head, the body naturally remains away from that position. Remove the tunnel syndrome, posture becomes easier, and the body can assume various postures (Lunghi *et al*., 2016, p.18). This explanation is at least as plausible for postural issues and change as any other narrative. Postural interventions often seem helpful for a range of problems. Such interventions might consist of exercise ("get stronger so that you can better support yourself and maintain better posture"), stretching ("stretch the tightness that prevents you from maintaining better alignment," or behavioral ("think about tucking your chin back to hold a more neutral spine"). All can be helpful, but is the remediation of the "problem" from which the dysfunction is viewed (weakness, tightness, poor habits) indeed the underlying cause? Does finding relief from performing exercise prove that weakness was the sole cause? Does being helped from stretching prove that tightness was the sole cause? Does improving as a result of behavioral modification prove that a faulty habit was the sole cause?

As a relevant aside, palpation is typically an integral aspect of MT, with each work style describing what is being palpated. Palpation is often thought of as a hierarchical process of learning and experience and part of the embodied art of manual therapy. It is frequently used to identify the position of structures, as in laryngeal elevation. In contrast, other forms of palpation are used to detect aberrant tissue quality, such as muscle tension, which is seen as an

indicator of problems. Through palpation, circumlaryngeal treatment models recommend seeking out tight areas that are seen to represent excessive muscle tone and, when paired with conclusions from the historical voice narratives (Aronson, 1990), in need of intervention. While her conclusions are not specific to voice dysfunction, Jacobs writes that tissue/skin quality that feels thickened may result from cutaneous nerve tunnel syndromes, which change over time with applied skin stretching. MT input, be it the more aggressive form used in circumlaryngeal treatment, or the lighter and more sustained, static stretching of the skin described by Jacobs (and me), impacts both dysfunctions and, over time, reduces those palpatory sensations that clinicians and patients note. Reduction in palpatory density linked with an improvement in the described condition often reinforces the stated mechanism of action from the clinician, another potential post hoc fallacy. While proponents of palpation from the many available models will rigidly defend its utility and accuracy from the perspective of their tissue or pathology beliefs, such widely overlapping and competing claims give further credence to the need for an acceptance of uncertainty. We feel *something* when we palpate, and often those *things,* when treated*,* lead to positive results when intervention is applied. So, if it is not the specific tissue or pathology that is thought to be at fault, what is it that is being palpated, and why do those palpated *things* change when intervention is applied? Jacobs' cutaneous tunnel syndromes? MFR's fascial restrictions? Possibly all (or none) of the above?

The model included throughout this text includes palpation as a primary means of communication and connection, which may seem odd with respect to what I just presented. However, instead of palpation serving as a primary diagnostic and assessment of progress role, finding the *what* (of what is wrong), I use palpation to begin communication with my patient about their issues. I judge improvement not by my subjective interpretation of palpation findings but on functional gains on the part of the patient, as well as accepted objective measurement tools. Subjective, clinician-reported changes in palpatory findings before and after an intervention have little credible validity. Many factors influence our post-treatment palpation, including a self-driven desire to feel that our ministrations were effective. Our ego biases claims relating to the accuracy of pre- and post-intervention palpation. Even if change does occur, can we accurately correlate changes in tissue texture to positive gains in function or performance? However, our patients often expect change to happen (and be noted via clinician palpation) post-treatment. When faced with such a conundrum, I often respond to patient inquires with, "it feels a bit different to me, but what are you feeling?" Instead of success being measured by me, I try to hand over these duties to my patient. It may matter little whether palpatory findings differ, but what they feel when I return to touch a previously symptomatic area matters more, as does the negative quality we were working to remediate.

Embedded in the skin and connective tissue, Ruffini endings (or corpuscles) register the skin's pressure and lateral deformation. They show little adaptation over time, meaning that if the stimulus (lateral skin stretching) remains in place, Ruffini endings continue to signal. Ruffini endings act in concert with other mechanoreceptors (Merkel's discs, Meissner's corpuscles, and Pacinian corpuscles) and signal to the primary somatosensory cortex and secondary cortical areas for processing. From there, it is up to the brain, and the conditions set out by the peripheral signaling for a determination if peripheral changes are indicated. This automatic and straightforward process is set in place by stimulation anywhere in the periphery, including our manual input. Ruffini endings as a possible explanation for change via MT is a personally intriguing perspective, as they detect the exact type of manual input applied when performing the slow, static engagement I use throughout my work. Merkel's discs are slow adapting and respond to sustained pressure of the sort used in this work. Meissner's corpuscles respond to low-frequency vibration and pressure, although they rapidly adapt and slow their response relatively quickly. Pacinian corpuscles quickly adapt and respond to transient deep pressure and higher-frequency vibration (Johnson,

2001; Macefield, 2021). In short, the various skin and connective tissue-based mechanoreceptors are unavoidable receivers of any type of mechanical input that clinicians can apply. While mechanoreceptor signaling to the brain does not directly create predefined outcomes, cortical processing can and may initiate some of the changes seen in MT or might be a more significant aspect of allowing awareness to occur. Relevance to the SLP profession would come from seeing how touch, no matter how applied, can stimulate awareness at many different levels rather than only to the muscle. Even if more aggressive manipulation-type input is provided to what is seen as muscular tension problems, there is an unavoidable impact from superficial mechanoreceptors that may account for some of the observed changes.

With ANS activation, it is known that there will be increased activity in laryngeal musculature, causing laryngeal reactivity in response to stress-inducing conditions (Helou *et al*., 2013). Fascial researcher Robert Schleip, in a 2003 paper, describes the inhibition of sympathetic activity as a known outcome of Ruffini ending stimulation. To restate this, inputting to Ruffini receptors by lightly stretching the skin in a sustained fashion has a known effect of reducing the fight or flight response. With certain types of massage and manual therapy, patient feedback after a session often involves the feeling of relaxation. While those comments could stem from many factors (time spent relaxing, being attended to), it is not inconceivable that this state is introduced, in part, by Ruffini stimulation. Contrast this with the possible reaction to a more aggressive (threatening) type of MT intervention, which may have the opposite effect on relaxation.

Given that learning and function seem optimal when sympathetic excitation diminishes and a person is relaxed, such MT-based skin stretching results are advantageous and desirable in any therapeutic setting. When seen as a potential gateway for behaviorally-based interventions, it can be easy to see how MT, provided as an early part of any intervention, may serve an additional benefit to the overall interaction, no matter what intervention follows. Whether from within the silo of laryngeal muscle activation or the more general aspect of motor activity and learning, reproducible options to reduce sympathetic dominance are worth pursuing.

Attempts to move MSK interventions forward from their mechanistic roots have been ongoing for many years. As my early teaching narratives evolved from a tissue-based one and into establishing a perspective centered on the nervous system to explain changes, reliance was made on a 2010 article from the journal *Physical Therapy* titled, "Increasing muscle extensibility: A matter of increasing length or modifying sensation?" (Weppler *et al*., 2010). In the article, the writers compare various traditional/historical narratives used to explain the effects of stretching. The early explanations came primarily from viscoelastic muscle perspectives and plastic deformation of connective tissue. The authors examined many such explanations and exposed both their strengths as well as their limitations. While theoretical mechanical models of tissue length changes have been present for decades, none have been shown to have an impact for more than a brief time frame, rendering the commonly used explanations for stretching effects inaccurate. With the existing perspectives rendered incomplete as a complete explanation, the authors then offered an alternative explanation, proposing that nervous system adaptations that modify sensation may account for the allowance of muscle length changes. It is stated that there is uncertainty over whether this modification in sensation occurs peripherally or centrally, and they also allow psychological factors to play a potential role. My simplistic interpretation of these findings is that we feel a stretch that may seem potentially harmful at first. However, after proving to ourselves that damage does not occur, we allow for changes in a range of motion by allowing an alteration in the perceived sensations of that stretch. The authors question whether muscle length alone is sufficient to stop a range of motion, or might a person's sensory perception of a stretch be sufficient to limit movement? While applying this paper pertains to traditional stretching and not directly to MT, parallels from this paper's conclusions to the various

forms of stretching utilized in MT-based and related treatments cannot be ignored.

Though not often seen as the specific or primary domain of the SLP, pain and discomfort are often primary symptoms of many voice disorders (Roy *et al*., 2009, p.125), with discomfort a frequent complaint in swallowing disorders. Much of the newer literature in the MT field looks at evolving models of MT's influence on pain, rendering a crossover link in seemingly disparate literature. The linkage between pain and MT is the focus of a paper by Bishop *et al.* (2015), titled, "What effect can manual therapy have on a patient's pain experience?" Bishop speaks to the lack of empirical evidence to support the many tissue-based theories and refers to neurophysiological mediators as more potential influencers. He speaks to spinal and supraspinal influences regarding adaptation responses from MT input in the periphery. While his inquiry was specific to pain, the critical thinking presented in his paper may be more broadly applied throughout the broader range of disorders. While Bishop acknowledges that mechanical properties in the peripheral structures allow *some* local change, the complete process for remediating pain involves spinal and paraspinal influences, including cortical adaptations, well beyond local peripheral responses.

Bishop translates peripherally applied interventions into centrally mediated impacts working from a blended mechanism of action. Pain itself can be physically and emotionally limiting to function, as fear of injury, thoughts of tissue damage, catastrophizing potential career and quality of life limitations, and wishing to minimize suffering can cause a reduction in movement as a potential means of reducing damage. Pushing through pain is actioned by some, seeing the value of retaining function or believing that movement will make the pain dissipate over time. However, pain and fear of injury or damage can be paralyzing in other individuals. These factors must be considered when devising a fuller model of MT impact.

In addition to the overlap into functional changes that emerges with a reduction in pain, Krisciunas *et al.* (2019) report an immediate reduction in inflammation and fibroblast activity with the application of MT, reducing potential scar formation, increasing muscle regeneration, and reducing the inflammatory effect of injuries.This paper focuses on manual therapy in treating post-head and neck cancer dysphagia but also includes voice disorders as co-morbidities suitable for improvement with MT.

Identifying the need for a more acceptable broad-based mechanism of action for manual therapy is a subject examined by several current authors. Bialosky *et al.* (2009) and Bialosky *et al.* (2018) explore many avenues of impact brought about by MT, including factors relating to the relationship between patient and provider and the context in which intervention occurs. He establishes his model as one driven, in part, by mechanical forces applied in the MT intervention triggering an imprecise and variable cascade of neurophysiologic impacts through peripheral, spinal, and supraspinal factors but allowing for autonomic and non-specific responses. Seeing the still unsubstantiated mechanical tissue-based changes as having limited viability, the act of applying mechanical force may be a trigger that signals wide-ranging sensory and perceptual actions capable of eliciting peripheral changes. Instead of seeing the tissues as the receiver and processor of a local mechanism of action for change, Bialosky views those tissues as the doorbell we push to bring in a wide range of possible influencers. Instead of local responses to peripheral tissues with MT input, these tissues acting as signalers to higher centers is a repeating theme across the newer models. Expanding impact views will allow the voice and swallowing clinician to utilize MT for treatment to broaden their focus and provide more plausible explanations to the patient. While incorporating the uncertainty of a multicentered model takes time to integrate, such a narrative will allow the clinician to provide a more accurate global explanation for the impacts of MT intervention.

The neurophysiology of affective touch is explored by Geri *et al.* (2019) in *Manual therapy: Exploiting the role of human touch*. Much is written of MT's ability to convey safety and comfort in the general MT and massage literature, although often stated in vague ways. Geri inserts viable physiological

reactions to touch into this conversation, bridging the gap between the esoteric and concrete. Touch has specific analgesic effects beyond simple distraction or reduction in hypervigilance (Geri *et al*., 2019; Mancini *et al*., 2014). Geri explains how MT can influence and improve upon a patient's body perceptions by reorganizing mental representations of the body, allowing them to better sense themselves as not injured. The "physiotherapists' hands may act similarly to patients' eyes, enhancing the sense of body ownership ('this is my body'), and improving the perceived sense of agency ('I am in control of my body')" (Geri *et al*., 2019, p.3). Geri describes contextually appropriate touch as having the ability to pass along meaningful messages of safety and agency from clinician to patient and allow regulation of emotions, all vital considerations. Viewing such impacts is far from the norm in the general and voice/swallowing disorders MT communities but needs to be included in any comprehensive model.

Geri opens doors through walls often placed between the clinician and patient. As mentioned above, in attempts to remain objective, clinicians frequently see themselves removed from the clinical experience or as an observer and not a part of the process. Tissue-based views often objectify the patient as if their tissues are accessible in a removed fashion. Viewing the researcher as a removed observer is possible in many forms of quantitative research, but such perspectives that embody both clinician and patient as active participants are myopic. Attempts to maintain this distance from a mutual process are impossible, although many view their work in such a light. I believe that manual therapeutic encounters should be acknowledged as an iterative process, with back-and-forth conditional trial and response and constant feedback between the two parties forming the basis of every clinical encounter. Rather than being removed from the intervention, the clinician's role in the process must be transparent and can be seen to parallel insider researcher models (Fleming, 2018). Acknowledgment of these mutual and intertwined roles in the therapeutic encounter may increase communication between the patient and clinician vs. a more removed model where the clinician acts as the operator and the patient functions as the passive receiver (Jacobs and Silvernail, 2011).

To reinforce the interconnectedness between clinician and patient, Cerritelli *et al.* (2017) published a study that looked at the clinician's impact on functional connectivity patterns in the patient's brain, specifically, if the clinician's attentiveness to the patient via touch mattered. Would an attentive clinician have more significant or different potential impacts than a non-attentive one? While it is beyond the scope of this book to describe the neuroscience of such as response, such functional connectivity patterns indicate that touch is creating awareness on the part of the patient and potentially bringing awareness back to the periphery. The study showed that the state of mind and attentiveness of the clinician mattered in that the clinician's attention to the task of touching increased the patient's functional connectivity patterns. Of particular interest, given the very long hold times inherent in the style of work used in the form of MT presented here, was the study's demonstration that hold times of 15 minutes allowed peak activation of the patient's functional conductivity."(As) a particular cognitive status of the operator is sustained over time, it can elicit significant effects in the subjects' functional connectivity between areas processing the interoceptive and attentional value of touch" (Cerritelli *et al*., 2017). Interoception is the perception of sensations inside the body. The influence of the state of mind of the clinician matters in ways we can prove from plausible, neuroscience-driven perspectives. In the past, such concepts were assigned more vague and esoteric explanations, given descriptors such as *presence* and *grounding*, but are now explainable from accepted scientific perspectives. Given these findings, might not slower, lingering styles of MT have the *potential* to be more impactful when working with voice and swallowing disorders that those applied more abruptly?

Transcending specific interventions, cognitive-based changes, and learning form the basis for explaining how change occurs throughout the therapeutic process, including in the voice (and swallowing) field

(Ziegler *et al*., 2014). Be it motor learning/relearning of mouth and tongue movement following radiation or a CVA, voice retraining to reduce strain or injury, or tongue tension exercises, cognitive learning plays a significant role in these achievements. While seldom explained in this context, the gains seen by manual therapy may be due to a very similar process. When we evolve from perceiving tissue-based change as the sole clinically relevant feature of MT and begin to see spinal/supraspinal influences, perceptual awareness, and cognitive learning factors as having played a collaborative role in the changes, the boundaries between MT and other voice/swallowing-related interventions will be reduced.

Behavioral factors are well-documented as possible contributors to MTD and other disorders (Ross, 1999, p.134; Sataloff, 2005, p.13; Roy *et al*., 2017; Rubin *et al*., 2000, p.13), with these factors contributing to the mosaic of factors that influence physical disorders. However, Roy's 2017 paper presents a range of demonstrable abnormal fMRI findings that were present pre-treatment but were reduced post-treatment as an outcome of manual circumlaryngeal therapy. Spengler *et al.* (2017) found that "pathological patterns in the amygdala-prefrontal circuit normalized after circumlaryngeal therapy and recovering of voice quality" in psychogenic aphonia (Spengler *et al*., 2017, p.122). Papers such as these represent a deepening understanding of MT and its influence on voice, with immediate changes seen in irregular brain-based patterns when MT is administered. While not refuting possible local, tissue-based impact as the sole reason for voice improvement, these studies point to future research into exploring the complexities of what was once thought a more straightforward narrative.

Every clinical intervention's aspects cannot be solely attributed to hands-on interaction, although the application of hands-on work contributes to the illusion of effect. Contextual or indirect factors play a role in any human interaction, therapeutic or not (Thomson *et al*., 2021). Meeting patient expectations, establishing therapeutic rapport, and more all impact manual therapy outcomes and non-manual therapy-based interventions. Testa *et al.* (2016) speak to how contextual factors influence outcomes in the therapeutic relationship. Fulton (2015) examines placebo and nocebo and how such factors play a role throughout the MT experience. Fulton and Testa discuss how to ethically leverage those factors through the clinical process. These contextual effects are far more than passive influences and have neurobiological and psychobiological influences on therapeutic outcomes. While not the sole domain of touch-based interventions, excluding these influences, minimizes the full range of factors commonly reported in historical MT narratives. A richer understanding of the potential impact of contextual factors may improve clinician-patient transparency and improve outcomes in the MT voice treatment setting.

Conclusions

While much has been explored and updated on the overall impacts of peripheral manual therapy intervention in the general therapeutic community, little has drifted into the field of MT for voice and swallowing, at least to be consistently applied across the literature. Despite updated understandings, many clinicians in all fields continue to utilize overly simplistic historical explanations and mechanisms of action. When current voice/swallowing MT literature perpetuates these stereotypes and clinicians accept such explanations, there is little reason for clinicians and academicians to update their understandings. For this reason, future MT research in the field of voice might move towards greater transparency regarding the lack of a fully understood mechanism of action. Further research is recommended to deepen such models. Using the literature review above as a template, further research may broaden upon this model, benefitting the entire field of MT. It is recommended that new outcome-based studies for the use of MT in voice, swallowing, breathing, oral motor dysfunction, and related disorders include mentioning the uncertainty of the known mechanisms of action and avoiding rehashing historical but non-proven explanations.

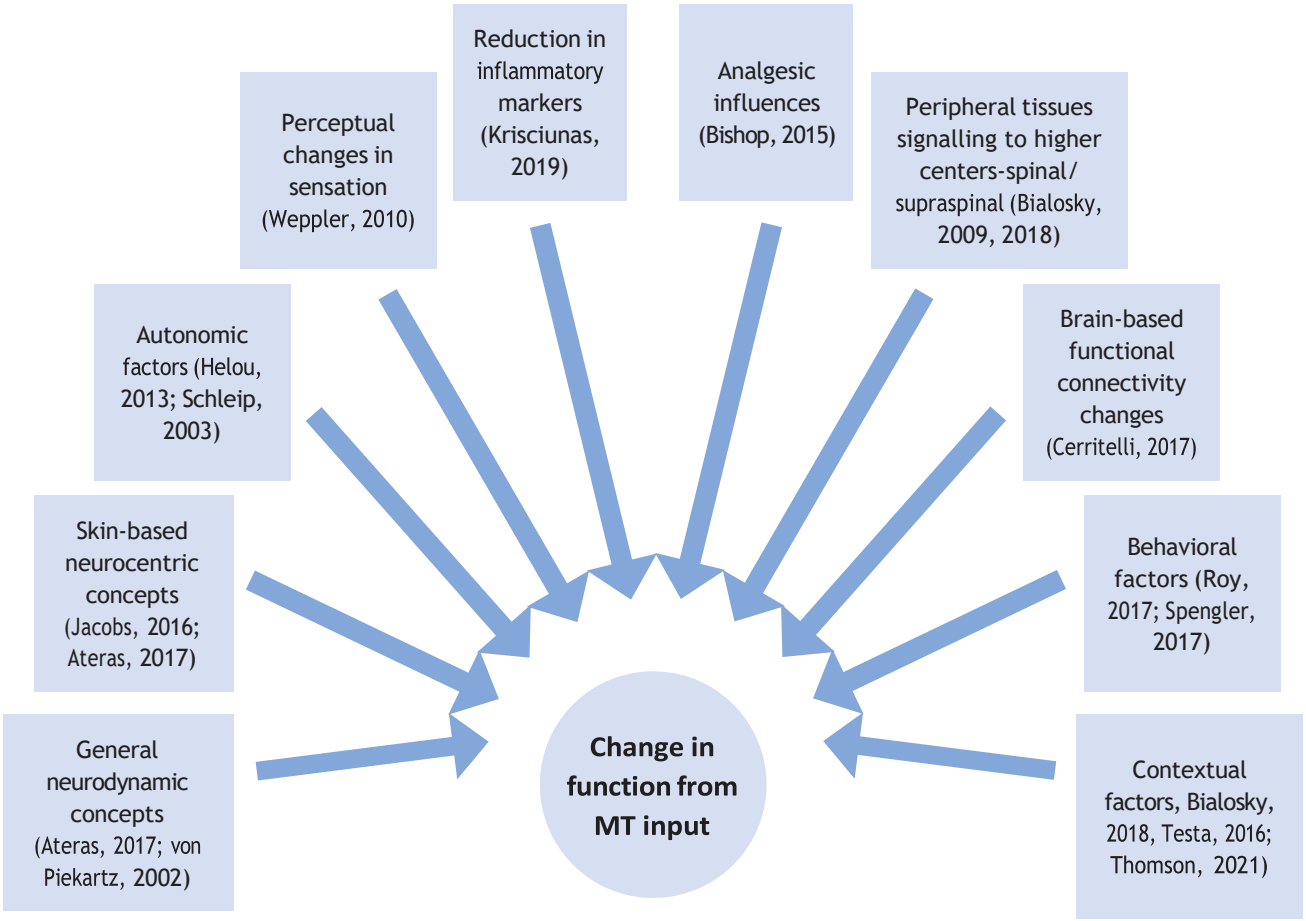


Figure 5.3 Possible explanations for manual therapy's impact.

Voice care in a clinical setting typically requires a holistic approach allowing for truly patient-centered rehabilitation. Vocal athletes have heightened vocal and physical demands putting them at risk for increased effort and potential injury and solid vocal technique is vital to minimize this risk. As singing is a dynamic process involving the entire body, rehabilitation, and habilitation both must address the musculoskeletal system. Skilled manual intervention opens a doorway to other body systems that play an equally valuable role when training the voice. Whether clinician led of self -guided, the student/patient-centered approach of Walt Fritz's technique helps promote a "slower gets you there faster" mindset- a concept often lacking in some "quick fix" approaches. All great voice training can be broken down into one core concept. It is facilitating a conversation, if not a negotiation with the nervous system. Skilled manual intervention initiates and mediates that conversation affecting longer-term, more permanent adaptations over time. The result is vocal efficiency, consistency, and adaptability, all of which are vital to safely meet the ever-changing industry demands of today's vocal athlete.

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